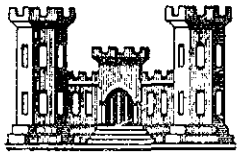
BLACKSTONE RIVER BASIN
AUBURN, MASSACHUSETTS

STONEVILLE POND DAM
MA 00126

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM



DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
WALTHAM, MASS. 02154

AUGUST 1978

REPORT DOCUMENTATION PAGE

READ INSTRUCTIONS BEFORE COMPLETING FORM

REPORT NUMBER: MA 00126	2. GOVT ACCESSION NO.
3. RECIPIENT'S CATALOG NUMBER	
TITLE (and Subtitle): Stoneville Pond Dam TIONAL PROGRAM FOR INSPECTION OF NON-FEDERAL MS	5. TYPE OF REPORT & PERIOD COVERED: INSPECTION REPORT
	6. PERFORMING ORG. REPORT NUMBER
AUTHOR(s): S. ARMY CORPS OF ENGINEERS W ENGLAND DIVISION	8. CONTRACT OR GRANT NUMBER(s)
PERFORMING ORGANIZATION NAME AND ADDRESS	10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS
CONTROLLING OFFICE NAME AND ADDRESS: PT. OF THE ARMY, CORPS OF ENGINEERS W ENGLAND DIVISION, NEDED 4 TRAPELO ROAD, WALTHAM, MA. 02254	12. REPORT DATE: August 1978 13. NUMBER OF PAGES: 70
MONITORING AGENCY NAME & ADDRESS (if different from Controlling Office)	15. SECURITY CLASS. (of this report): UNCLASSIFIED 15a. DECLASSIFICATION/DOWNGRADING SCHEDULE

DISTRIBUTION STATEMENT (of this Report)

PROVAL FOR PUBLIC RELEASE: DISTRIBUTION UNLIMITED

DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)

SUPPLEMENTARY NOTES

ver program reads: Phase I Inspection Report, National Dam Inspection Program; lever, the official title of the program is: National Program for Inspection of l-Federal Dams; use cover date for date of report.

KEY WORDS (Continue on reverse side if necessary and identify by block number)

MS, INSPECTION, DAM SAFETY,

lackstone River Basin
lburn, Mass.

ABSTRACT (Continue on reverse side if necessary and identify by block number)

oneville Pond Dam is an earthfill dam with a concrete ogee spillway. The dam has maximum height of 20 feet and is approximately 290 feet long. It is considered be in fair condition. An outflow of 9,850 cfs (½ the PMF) will overtop the idge by about 3.4 feet.The dam is considered to have a "high" hazard potential.

STONEVILLE POND DAM

MA 00126

BLACKSTONE RIVER BASIN
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PHASE I INSPECTION REPORT
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PHASE I INSPECTION REPORT

BRIEF ASSESSMENT

Identification No.: MA00126

Name of Dam: Stoneville Pond

Town: Auburn

County and State: Worcester County, Massachusetts

Stream: Kettle Brook - a tributary of Blackstone River

Date of Inspection: July 31, 1978

Stoneville Pond Dam is an earthfill dam with a concrete ogee spillway. A dam was originally built at this site in about 1876. The existing dam was constructed in 1904 with major repairs performed in 1948. Oxford Street forms the crest of the dam, and the bridge on Oxford Street passes over the spillway channel near the south end of the dam. The dam has a maximum height of 20 feet and is approximately 290 feet long. The spillway is constructed of concrete over a rock-filled timber structure. Normal discharge is over the weir, through the channel formed by the stone masonry abutments under the bridge, and down the stream channel (Kettle Brook).

The weir, which is divided into two sections 40 and 49 feet long, is separated by a 10.2-foot long concrete gate structure on the crest of the weir. On top of the structure are two inoperable gate stems that would ordinarily regulate the flow through the slide gates at the toe of the spillway. At the time of the inspection the gates were closed.

Stoneville Pond Dam was neither designed nor constructed according to current approved state-of-the-art procedures. Based upon the visual inspection at the site, the limited engineering data, and little evidence of operational or maintenance procedures, it was concluded that several conditions must

be corrected to assure the continued performance of this dam. Generally, Stoneville Pond Dam is considered to be in fair condition. Because of the potential danger to lives and property downstream Stoneville Pond Dam has been classified as a "high" hazard.

The following visible signs of distress indicate a potential hazard at the site: seepage in the stone masonry abutments under the bridge; inoperable slide gates and inaccessibility of the gate mechanisms during periods of high flow; spalling concrete on the weir and on the gate structure; lack of adequate riprap protection on the upstream face of the dam; erosion at the downstream slope caused by surface runoff, and thick vegetation growing on the north abutment of the dam.

Hydraulic analyses indicate that the spillway can discharge a flow of 4,500 cubic feet per second (cfs) at elevation (El) 520.5, which is the lowest point on the bridge. An outflow test flood of 9,850 cfs (one-half the probable maximum flood) will overtop the bridge by about 3.4 feet. The spillway may be inadequate since it can discharge only 46 percent of the test flood before the dam is overtopped. In the event of overtopping, complete failure of the dam could occur.

It is recommended that the Owner employ a qualified consultant to evaluate the stability of the dam, conduct a more detailed hydrologic and hydraulic investigation, and evaluate the seepage in the stone abutments. It is also recommended that the Owner repair the concrete on the weir and outlet structure; repair the gate mechanisms and construct some form of access walk to the gate controls; add riprap to the upstream slope of the dam, and remove all trees from the area of the north abutment of the dam. The Owner should also implement a systematic program of inspection and maintenance.

The above recommendations and remedial measures should be implemented by the Owner within a period of one year after receipt of the Phase I Inspection Report. An alternative to these recommendations would be draining the pond and breaching or removing the dam.

Edward M. Greco, P.E.
Project Manager
Metcalf & Eddy, Inc.

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Approved by:

Stephen L. Bishop

Stephen L. Bishop, P.E.
Vice President
Metcalf & Eddy, Inc.

Massachusetts Registration
No. 19703

This Phase I Inspection Report on Stoneville Pond Dam has been reviewed by the undersigned Review Board members. In our opinion, the reported findings, conclusions, and recommendations are consistent with the Recommended Guidelines for Safety Inspection of Dams, and with good engineering judgment and practice, and is hereby submitted for approval.

CHARLES G. TIERSCH, Chairman
Chief, Foundation and
Materials Branch
Engineering Division

FRED J. RAVENS, Jr., Member
Chief, Design Branch
Engineering Division

SAUL C. COOPER, Member
Chief, Water Control Branch
Engineering Division

APPROVAL RECOMMENDED:

JOE B. FRYAR
Chief, Engineering Division

PREFACE

This report is prepared under guidance contained in Recommended Guidelines for Safety Inspection of Dams, for a Phase I Investigation. Copies of these guidelines may be obtained from the Office of Chief of Engineers, Washington, D. C. 20314. The purpose of a Phase I Investigation is to identify expeditiously those dams which may pose hazards to human life or property. The assessment of the general condition of the dam is based upon available data and visual inspections. Detailed investigation, and analyses involving topographic mapping, subsurface investigations, testing, and detailed computational evaluations are beyond the scope of a Phase I Investigation; however, the investigation is intended to identify any need for such studies.

In reviewing this report, it should be realized that the reported condition of the dam is based on observations of field conditions at the time of inspection along with data available to the inspection team. In cases where the reservoir was lowered or drained prior to inspection, such action, while improving the stability and safety of the dam, removes the normal load on the structure and may obscure certain conditions which might otherwise be detectable if inspected under the normal operating environment of the structure.

It is important to note that the condition of a dam depends on numerous and constantly changing internal and external conditions, and is evolutionary in nature. It would be incorrect to assume that the present condition of the dam will continue to represent the condition of the dam at some point in the future. Only through continued care and inspection can there be any chance that unsafe conditions be detected.

Phase I inspections are not intended to provide detailed hydrologic and hydraulic analyses. In accordance with the established Guidelines, the Spillway Test flood is based on the estimated "Probable Maximum Flood" for the region (greatest reasonably possible storm runoff), or fractions thereof. Because of the magnitude and rarity of such a storm event, a finding that a spillway will not pass the test flood should not be interpreted as necessarily posing a highly inadequate condition. The test flood provides a measure of relative spillway capacity and serves as an aide in determining the need for more detailed hydrologic and hydrualic studies, considering the size of the dam, its general condition and the downstream damage potential.

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LOWER STONEVILLE POND
AUBURN, MASSACHUSETTS

VIEW FROM SOUTH EDGE OF POND

Location and Direction of Photographs
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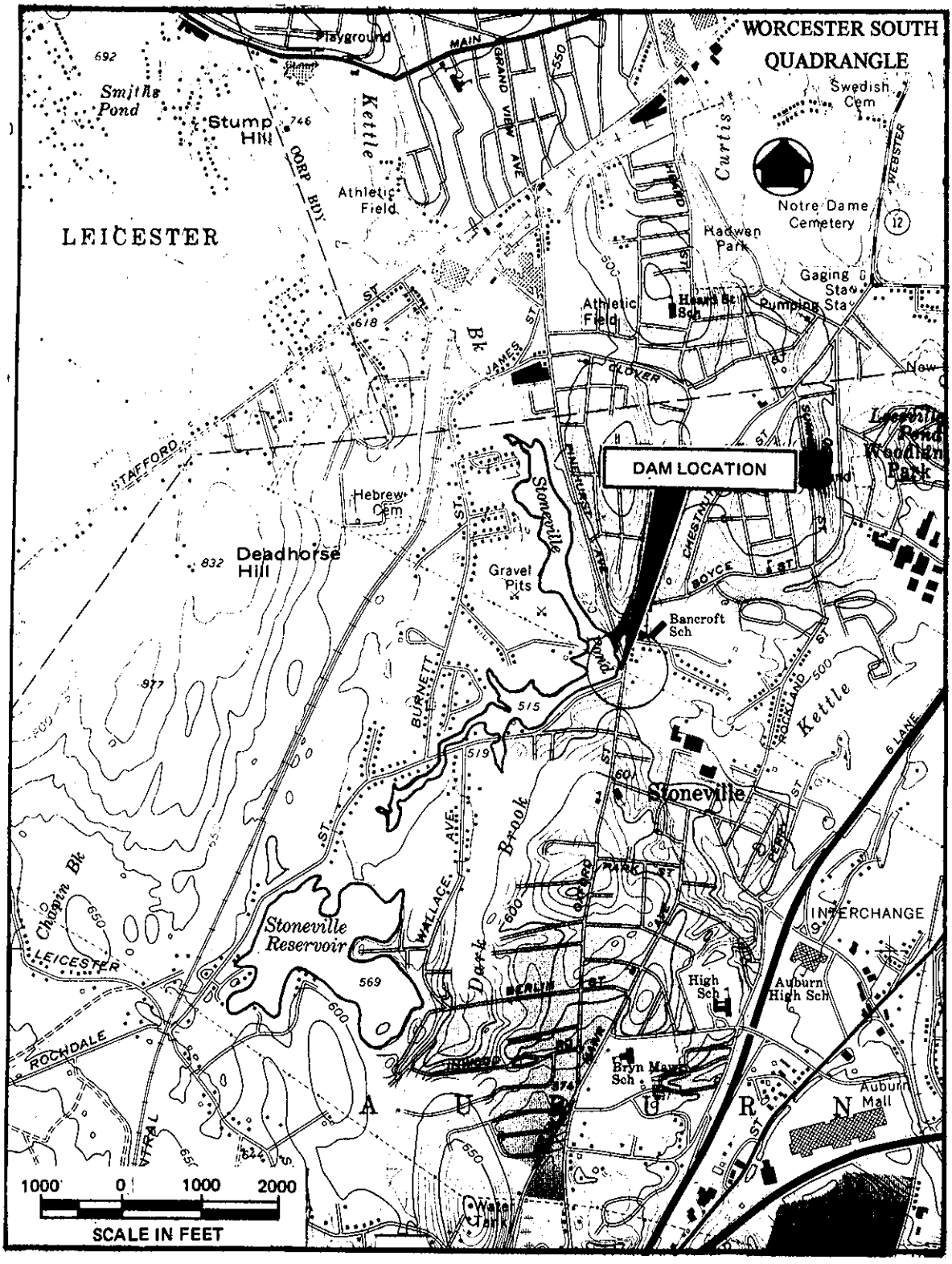


LOCATION MAP - STONEVILLE POND DAM

NATIONAL DAM INSPECTION
PROGRAM

PHASE I INSPECTION REPORT

STONEVILLE POND

SECTION 1

PROJECT INFORMATION

1.1 General

a. Authority. Public Law 92-367, August 8, 1972, authorized the Secretary of the Army, through the Corps of Engineers, to initiate a national program of dam inspection throughout the United States. The New England Division of the Corps of Engineers has been assigned the responsibility of supervising the inspection of dams within the New England Region. Metcalf & Eddy, Inc. has been retained by the New England Division to inspect and report on selected dams in the State of Massachusetts. Authorization and notice to proceed was issued to Metcalf & Eddy, Inc. under a letter of May 3, 1978, from Ralph T. Garver, Colonel, Corps of Engineers. Contract No. DACW 33-78-C-0306 has been assigned by the Corps of Engineers for this work.

b. Purpose:

(1) Perform technical inspection and evaluation of non-Federal dams to identify conditions which threaten the public safety and thus permit correction in a timely manner by non-Federal interests.

(2) Encourage and assist the States to initiate quickly effective dam safety programs for non-Federal dams.

(3) Update, verify and complete the National Inventory of Dams.

1.2 Description of Project

a. Location. The dam is located in the Town of Auburn, Worcester County, Massachusetts, on Kettle Brook, a tributary of the Blackstone River. Stoneville Pond is immediately downstream of Stoneville Reservoir (see Location Map and Watershed Plan, Figure D-1),

b. Description of Dam and Appurtenances. A dam was originally built at this site in 1876. The existing dam was constructed in 1904 with major repairs performed in 1948. Stoneville Pond Dam is an earthfill dam with a concrete ogee spillway that is about 290 feet long and a maximum of 20 feet high (see Appendix B, Figures B-1 and B-2). Oxford Street, which forms the crest of the dam, is generally 42 feet wide, although the dam is wider in a filled area on the downstream side of the north abutment of the dam. The street is bounded by guard rails for the length of the dam. The elevation of the crest varies from 518.7 to 522.3. The upstream slopes vary from 3:1 to 12:1, and the downstream slopes from 2:1 to 4:1, both slopes are covered with brush and trees. Several small commercial buildings are situated adjacent to the downstream side of the abutments. Rochdale Street intersects Oxford Street at the upstream side of the south abutment. This area has been stripped of soil and vegetation during the construction of a sewer line along Rochdale Street and across Oxford Street to a manhole near the south bank of Kettle Brook. There is a high tension line tower supported on concrete piers on the shore of the pond at the north spillway abutment.

The spillway is situated near the south portion of the dam. There is a low stone wall at the south spillway approach. The spillway is an ogee-type weir constructed of a rock filled timber structure covered with reinforced concrete (see Figure B-3). Beneath this is reported a 30-foot long cutoff trench constructed of puddled clay between 2-1/2-inch timber sheeting. The crest of the spillway

is divided into two sections by a 10.2-foot long concrete gate structure. The south section is 40 feet long and the crest is at El 515.0 The north section is 49 feet long and is 0.2 feet higher than the south section. Water flows over the weir, down the sloping concrete face of the spillway and drops vertically 2 feet to the concrete slab at the toe. The slab extends through the channel to 18 feet downstream of the road bridge.

The Oxford Street bridge passes over the spillway channel just downstream of the crest of the weir. The bridge deck is constructed on steel girders which are supported by both masonry sidewalls capped with concrete and by two concrete piers about 2-1/2 feet in diameter on 4 foot wide concrete pads. Two fieldstone masonry abutments extend into the spillway channel 37 and 25 feet, respectively from the north and south sidewalls and 9 feet downstream of the toe of the weir (see Figure B-1). As a result, the hydraulic width of the channel under the bridge is reduced to 35.7 feet for a distance of about 29 feet. In 1948, a concrete toe wall was constructed at the upstream end of this channel (see Figure B-3).

The concrete gate structure is 2 feet higher than the crest of the weir. It includes a concrete twin box conduit that discharges at the toe of the spillway. The remains of two gate stems are visible at the top of the structure. The gates are not operable. The only access to the gates is across the crest of the weir. The inlet is submerged. The outlet is centered in the channel under the bridge and consists of two 3-foot-wide by 2.5-high concrete box conduits.

As recently as 1976, a canal crossed under Oxford Street through a stone box culvert at the south abutment of the dam and continued downstream to the Queensbury Combing Company mills. Recent construction has caused the

inlet of the conduit to be removed and the outlet to be blocked with fill for at least 100 feet; consequently there is no longer any flow through the canal.

c. Size Classification. Stoneville Pond dam is classified in the "small" size category since it has a maximum height of 20 feet and a maximum storage capacity of 400 acre-feet.

d. Hazard Classification. There are several small commercial buildings situated adjacent to the dam abutments, and a few abandoned mills downstream on Kettle Brook. Residential development is limited to about 25 houses downstream of the dam, and most of these are built on high ground, at least 10 feet above the elevation of the stream bed. There is also a high tension tower on the left upstream abutment, and the power line extends down the valley of Kettle Brook. Downstream of Rockland Street the brook flows through a swamp and finally reaches Leesville Pond where there is a flood control diversion dam. Failure of the dam could cause washouts of nearby buildings on Oxford Street, and release a flood wave about 4 feet high. This wave could threaten lives and property of the few residences living directly on Kettle Brook before it enters the swamp. Also the high tension tower would probably be washed out, leaving the power line inoperable and inaccessible for repair during the flood period. For these reasons the dam has been classified in the "high" hazard category.

e. Ownership. The dam is presently owned by the Massachusetts Electric Company, 939 Southbridge Street, Worcester, Massachusetts 01610. Mr. Barry Huston, District Superintendent (617-791-8511) granted permission to enter the property and inspect the dam.

f. Operator. There is no operable equipment and the Massachusetts Electric Company no longer operates the dam.

g. Purpose of the Dam. The original dam on Kettle Brook was built to provide water via the canal for processes at the textile mills in Auburn owned by C. W. and J. E. Smith, and later for the Queensbury Combing Company, also in Auburn. In 1945 the dam was purchased by the Worcester Electric Light Company although the Queensbury Combing Company retained water rights. Worcester Electric later became part of Massachusetts Electric Company and used the storage water for cooling purposes. Massachusetts Electric has not used the dam for about 15 years, however, and the reservoir is currently used only for recreation.

h. Design and Construction History. There is no information available on the design or construction of the original dam built on Kettle Brook in 1876. A plan dated December, 1948, citing local information, states that the masonry abutments for the bridge were constructed in 1876. It is not known when the mill canal was excavated.

The existing dam was built in 1904 and the first information on its construction or condition is noted in the 1925 Worcester County inspection records. Minor repairs to the spillway to prevent local seepage were then recommended by the County. The spillway was refaced with concrete in 1925 and 1931, and the stones in the south abutment were replaced in 1931 as well. The 1933 inspection report recommended reconstructing the abutment walls where necessary and removing trees on the dam embankment.

The existing Oxford Street bridge was constructed on the masonry walls in 1934, during which time the pond level was lowered.

Flooding in March, 1936, is reported to have caused some erosion of the masonry walls that extend into the spillway channel under the street. According to the 1948 plan, the Town of Auburn backfilled eroded areas in 1948, using material that had been deposited downstream during the flood.

Also in 1948 major repairs were made to the spillway section. A minimum 8-inch thickness of reinforced concrete replaced the deteriorated concrete face on the north section of the lower slope of the ogee weir. A 12-inch concrete slab was placed on the masonry at the toe of the weir, and a concrete toe wall was placed between the masonry abutments. Apparently there were flashboards on the weir at one time, but there is no evidence of them now.

The downstream slope of the left dam abutment was filled in for about 70 feet at some time, and there are now buildings and a parking lot built on the fill.

There is no other record of any further repairs made to the dam. The condition of the dam slowly deteriorated and by 1963 the canal was silted up and filled with debris, the masonry walls under the bridge were leaking in several places, and the gates were inoperable.

In 1978, the Town of Auburn built a sewer along Rochdale Street to a manhole in the right abutment of the dam. During this construction, the culvert for the canal was demolished and backfilled from the pond to the centerline of the road, and construction fill was dumped at the outlet end. A manhole was installed 50 feet downstream of the right abutment, but at the time of the inspection the slope had not been restored.

i. Normal Operating Procedure. There are no operational procedures at the dam, flow over the spillway is uncontrolled.

1.3 Pertinent Data

a. Drainage Area. The drainage area for Stoneville Pond is estimated to be 12,000 acres (18.7 square miles). It comprises about 58 percent of the drainage area tributary to the Corps of Engineers' control dam located about a mile downstream on Leesville Pond (see Figure

D-1 showing the relative location of the pond in the watershed). Kettle Brook flows from the northwest and includes five major reservoirs for public water supply. The brook flows through rural, sparsely developed woodland until it reaches the municipal airport and the Worcester City limits, where there is more residential development. It enters the north branch of Stoneville Pond just inside the Town of Auburn. Dark Brook flows from Dark Brook Reservoir and enters Stoneville Pond at the southwest branch. Stoneville Reservoir is located just west of Dark Brook and discharges directly into Stoneville Pond.

b. Discharge at the Dam Site. Uncontrolled discharge at the dam site flows over the 89 foot-long ogee weir on each side of the concrete gate structure, through the 36 foot wide passage beneath Oxford Street and into the stream channel. The channel is approximately 35 feet wide at the toe of the concrete apron downstream of the bridge. It is bounded by randomly placed fieldstone to a point about 85 feet from the bridge, and then narrows to 10 feet with a natural pavement of cobbles and boulders. A second high tension tower is located near the downstream channel, Kettle Brook. The channel is bounded by trees, and flows under Rockland Street and into a swamp before it discharges into Leesville Pond.

In 1959, the Corps of Engineers constructed a flood control diversion structure across Leesville Pond, approximately 1 mile downstream from Stoneville Pond Dam. The purpose of the structure, called the Worcester Diversion, is to divert flow from Kettle Brook to the Blackstone River, thereby reducing flood flows to Webster Square. Water entering Leesville Pond can flow either through the gates of the control dam or into the ungated overflow intake and tunnel that leads to the Blackstone River.

Hydraulic analyses indicate that the spillway can discharge an estimated 4,500 cfs at El 520.5, which is the lowest point on the bridge.

An inflow test flood of 10,285 cfs (one-half the probable maximum flood) adjusted for surcharge storage results in a maximum discharge of 9,850 cfs. This outflow will overtop the bridge by about 3.4 feet. A 1964 inspection report by the New England Power Services Company states that water reached a maximum depth of 4.2 feet above the crest of the spillway during the 1955 flood. According to this report, water spilled across Oxford Street at the south end of the bridge where the road surface is 3.5 feet above the crest of the spillway.

Controlled discharge was formerly through the slide gates which are closed and no longer operable.

There is no longer any flow through the mill canal, since it has been blocked by recent construction.

c. Elevation (feet above MSL (Mean Sea Level)). A benchmark was established at El 515.0 at the crest of the spillway. This elevation was estimated from a United States Geological Survey (USGS) topographic map.

(1) Top dam: 520.5 to 522.3

(2) Test flood pool: 523.9

(3) Design surcharge (original design): unknown

(4) Full flood control pool: N/A

(5) Recreation pool: 515.0

(6) Spillway crest (ungated): 515.0 to 515.2

(7) Upstream portal invert diversion tunnel: N/A

(8) Stream bed at centerline of dam: 502.2

(9) Tailwater: 502.8 (water in downstream channel)

d. Reservoir

(1) Length of maximum pool: 3,500 feet

(2) Length of recreation pool: 3,500 feet

(3) Length of flood control pool: N/A

e. Storage (acre-feet)

(1) Test flood surcharge: 360 at El 523.9

(2) Top of dam: 620

(3) Flood control pool: N/A

(4) Recreation pool: 400 (Approximate)

(5) Spillway crest: 400

f. Reservoir Surface (acres)

*(1) Top dam: 40

*(2) Test flood pool: 40

(3) Flood-control pool: N/A

(4) Recreation pool: 40

(5) Spillway crest: 40

g. Dam

(1) Type: earthfill

(2) Length: 290 feet

*Based on the assumption that the surface area will not significnatly increase with changes in pond elevation from 515.0 to 520.5.

(3) Height: (maximum) 20 feet

(4) Top width: 42 feet (Oxford Street)

(5) Side slopes: Variable; upstream 3:1 to 12:1
downstream 2:1 to 4:1

(6) Zoning: Unknown

(7) Impervious core: Unknown

(8) Cutoff: 30 feet long under spillway - puddled clay between 2-1/2 inch timber sheeting

(9) Grout curtain: Unknown

i. Spillway

(1) Type: ogee-type weir

(2) Crest length: 89.0 feet

(3) Crest elevation: South - 515.0 (assumed benchmark)
North - 515.2

(4) Gates: two gates near center of spillway, each 2.5 feet high and 3 feet wide

(5) Upstream channel: mortared masonry sidewalls at spillway

(6) Downstream channel: A 35-foot-wide concrete apron at the toe of the spillway extends 20 feet downstream of the bridge, below this the natural channel is bounded by randomly placed fieldstone. The channel narrows to 10 feet about 85 feet downstream of bridge.

j. Regulating Outlets. The only regulating outlets at this dam are the two 2.5- by 3-foot sluice gates located on the spillway, 40 feet north of the south training wall. The outlets have a combined capacity of 150 cfs (8.02 cfs per square mile). The gates have not been operated in about 15 years, and parts of the opening mechanisms are missing.

SECTION 2

ENGINEERING DATA

2.1 General. The only available plan of Stoneville Pond Dam is a drawing by the New England Power Service Company which indicates repairs made to the dam in 1948 (see Figure B-3). Visual observations during inspection, review of previous inspection reports, and conversations with the Owner and with personnel from Town, State and County agencies provided the remainder of the data for this evaluation.

We acknowledge the assistance and cooperation of personnel of the Massachusetts Department of Public Works, Messrs. Willis Regan and Raymond Rochford, and personnel of the Massachusetts Department of Environmental Quality Engineering, Division of Waterways, Messrs. John J. Hannon and Joseph Iagallo.

Also, we acknowledge the cooperation and assistance of personnel from the Worcester County Engineer's Office, Messrs. John O'Toole, Joseph Brazauskas, and Mr. Wallace Lindquist - recently retired from county service.

Mr. Barry Huston, District Superintendent for the Massachusetts Electric Company, granted permission to enter the property and inspect the dam. Mr. Stanley Meleski, of Massachusetts Electric, and Mr. Denton Nichols, of the New England Power Service Company, provided background data on the dam and pond.

2.2 Construction Records. The only available construction record is the 1948 drawing included in Appendix B. There are no as-built drawings for the dam.

2.3 Operation Records. No operating records are available for the dam and no daily record is kept of the elevation of the pool or rainfall at the dam site. A USGS gaging station is located on Kettle Brook about 2-1/2 miles downstream from the dam.

2.4 Evaluation.

a. Availability. Due to the age of this dam, there is limited engineering data available.

b. Adequacy. The lack of indepth engineering data did not allow for a definitive review. Therefore the adequacy of this dam could not be assessed from the standpoint of reviewing design and construction data, but is based primarily on visual inspection, past performance history and sound engineering judgment.

c. Validity. The limited engineering data available is valid.

SECTION 3

VISUAL INSPECTION

3.1 Findings

a. General. The Phase I Inspection of the dam at Stoneville Pond was performed on July 31, 1978. A copy of the inspection check list is in Appendix A. Periodic inspections of this dam have been made by others since 1925. A partial listing of these inspections is in Appendix B. An inspection by the Massachusetts Department of Public Works was made in 1976, and a copy of that report is also included in Appendix B. In addition, early inspection reports were reviewed at the Worcester County Engineer's office and at the office of the New England Power Service Company.

b. Dam. In general the dam is in fair condition. Sewer construction at the south abutment was in progress, and the south slope of the downstream channel had not been restored. Surface runoff from the road is eroding the embankment at the south end. The concrete railing on the bridge is crumbling.

The slopes of north abutment are completely covered with brush and trees. A 38-foot masonry wing wall, sloping from the north end of the bridge to the downstream toe, is obscured by the dense vegetation. There is no riprap protection of the upstream slope even in the vicinity of the high tension tower.

c. Appurtenant Structures. The concrete and stonework of the spillway are in poor to fair condition. Pieces of the dry stone masonry training wall at the south abutment are dislodged. Some of the masonry of the spillway sidewalls is missing, and there is a crack in the concrete cap over the north sidewall. At the time of the inspection, water was flowing over the south section of the ogee weir.

The concrete facing of the spillway is eroding away, and there are local areas of cavitation, and heavy staining of the surface. Slight to moderate seepage was noted on the north and south masonry abutments under the bridge along the spillway channel. The concrete slab of the channel is in fair condition with an irregular, eroded surface and evidence of severe cavitation on the upstream section of the slab. The downstream channel has some stone placed on its banks for about 80 feet, and the channel is relatively clear except for a few overhanging bushes and construction debris on the south bank.

The outlet structure is in poor condition. The inlet is not visible. The gate structure on the weir shows minor spalling and efflorescence on the concrete and some cracking as well. The two gate stems on the concrete are reportedly inoperable. Presently, the only access to the gates is across the crest of the weir, which makes the gate control mechanism entirely inaccessible during high flows.

The outlet from the gate structure is a double concrete box conduit that discharges at the toe of the spillway. The closed gates are not visible and there is no leakage. The concrete is in poor condition, showing evidence of spalling, erosion, and moderate cracking.

d. Reservoir Area. Heavily populated areas are located on the east and south sides of the pond in the vicinity of Stoneville. On the west side of the pond there is moderate residential development in the subdivisions east of Burnett Road. The Penn Central Railroad is just west of Burnett Road. A high-tension power line crosses the pond at the dam and continues along the downstream channel and flood plain.

e. Downstream Channel. The discharge from the spillway flows down Kettle Brook along the easement, then enters a wooded swamp area before it flows into Leesville Pond. When the mill canal was open, a second stream flowed through the canal to the mills about 1,500 feet downstream. The canal is now abandoned and is partially filled.

3.2 Evaluation. The above findings indicate that the dam has several areas of distress that require attention. It is evident that the dam is not maintained and that deterioration will continue unless action is taken. Recommended measures to improve these conditions are included in Section 7.

SECTION 4

OPERATING PROCEDURES

4.1 Procedures. There are no operating procedures at Stoneville Pond Dam.

4.2 Maintenance of Dam. There is no longer any maintenance program at the dam. The Town of Auburn will be responsible for restoration work at the south abutment and the canal once the sewer construction is completed.

4.3 Maintenance of Operating Facilities. The outlet gates are closed and cannot be opened with the existing mechanisms. Flow over the spillway is uncontrolled.

4.4 Description of Any Warning System in Effect There is no warning system in effect at the dam.

4.5 Evaluation. Stoneville Pond Dam is in fair condition and has been placed in the "high" hazard category because of the possible danger to life and property downstream and damage to the high tension power line. For this reason, it is important that procedures for operation, maintenance, and emergencies be implemented as recommended in Section 7.

SECTION 5

HYDRAULIC/HYDROLOGIC

5.1 Evaluation of Features

a. Design Data. The U. S. Corps of Engineers has developed a detailed peak flow at Leesville Pond Dam based on the probable maximum precipitation storm. A comparison of the areas tributary to Leesville and Stoneville Pond as shown on a USGS map indicates that the drainage area of Stoneville Pond has hydraulic characteristics similar to the drainage area of Leesville Pond. Accordingly, the Leesville probably maximum flood (PMF) rate of 1,100 cfs per square mile PMF rate was used for Stoneville Pond. The PMF estimates may be conservatively high under present watershed conditions, but allow for changes in watershed that are likely with further urbanization in the Worcester area. Applying one-half the PMF to the 18.7 square miles of drainage area results in a calculated peak flood flow of 10,285 cfs as the inflow test flood. By adjusting the inflow test flood for surcharge storage, the maximum discharge rate was established as 9,850 cfs (527 cfs per square mile) with a water surface at El 523.9.

Flow over the crest of the dam is predicted to be 1,350 cfs, and flow through the spillway and under the highway bridge would be 8,500 cfs. The maximum head on the dam would be 3.4 feet with a discharge of 7.1 cfs per foot of width. Depth at critical flow would be at 1.16 feet with a velocity of 6.1 feet per second.

Hydraulic analyses indicate that the existing spillway can discharge a flow of 4,500 cfs at water surface El 520.5 which is the lowest point on crest of the dam on the highway bridge.

b. Experience Data. Hydraulic records are not available for this dam, however, information supplied by the Owner indicated that water reached a maximum depth of 4.2 feet above the

crest of the spillway during the 1955 flood. Water also spilled across Oxford Street at the southern end of the bridge where the road surface is only 3.5 feet above the crest of the spillway. It is not known what the pond elevation was prior to the storm and what quantity of flow was discharged by the canal.

c. Visual Observations. Discharge from Stoneville Pond is over the spillway located immediately upstream of the Oxford Street bridge. The bridge abutments form a 36-foot wide culvert downstream from the spillway. The spillway is an 89-foot-long ogee weir composed of two sections separated by a 10.2-foot-long concrete gate structure.

The concrete spillway is in fair condition; it is heavily stained and severely pitted. Sections of the concrete gate structure are spalled. The southern section of the ogee weir is 0.2 feet lower than the northern section.

d. Overtopping Potential. Overtopping of the dam by about 3.4 feet is expected under the outflow test flood of 9,850 cfs. In the event of overtopping, however, complete failure of the dam could occur.

Failure of the dam would produce a peak discharge of 13,000 cfs and a flood wave 4.3 feet high, at a point 2,700 feet downstream of the dam, as estimated using the Corps of Engineers criteria.

SECTION 6

STRUCTURAL STABILITY

6.1 Evaluation of Structural Stability

a. Visual Observations. The evaluation of the structural stability of the dam is based on the visual inspection conducted on July 31, 1978.

Based on the observations as discussed in Section 3, Visual Inspection, it is recommended that a more detailed investigation be initiated to evaluate the stability of the dam and the seepage at the stone masonry abutments under the bridge.

b. Design and Construction Data. Discussions with the Owner and County and State personnel indicate that other than the 1948 drawing showing repairs to the spillway, there are no available plans, specifications, or computations on the design, construction, or repair of the dam. Information on the type, shear strength and permeability of the soil and/or rock materials is nonexistent. A 1964 inspection report by the Owner suggests that fill from the original highway bridge was subsequently used to build up the embankment on either side of the spillway. Recent excavation for the sewer line in the vicinity of the south abutment has removed some of the fill material, and no core wall or cutoff is evident.

The 1948 Plan (Figure B-3) shows details of the repairs to the spillway and the location of the toe wall. A 1977 inspection report by the Massachusetts Department of Public Works (see Appendix B) describes the spillway as a "rock filled timber crib structure" over a "cutoff consisting of 30 feet (horizontal) of clay (puddled) and two 2-1/2-inch timber sheet walls."

c. Operating Records. There is no evidence that any type of instrumentation had ever existed at Stoneville Pond Dam. The performance of the spillway and dam under prior loading can only be inferred from physical evidence at the site.

d. Post-construction Changes. The only recorded changes after 1948 were repairs undertaken by the Owner in 1958. These included resurfacing parts of the ogee section, chinking the masonry joints in the bridge abutments, and replacing stones.

Subsequent to 1976, the canal in the south abutment area was abandoned. In 1978, during the sewer construction program, the inlet to the canal was removed and the canal filled in.

e. Seismic Stability. The dam is located in Seismic Zone No. 2 and in accordance with Phase I "Recommended Guidelines" does not warrant seismic analyses.

SECTION 7

ASSESSMENT, RECOMMENDATIONS AND REMEDIAL MEASURES

7.1 Dam Assessment

a. Condition. Built in 1904, Stoneville Pond Dam was neither designed nor constructed according to current approved state-of-the- art procedures. Based upon the visual inspection, the limited engineering data, and no evidence of operation or maintenance, it is determined that various conditions must be corrected to assure the continued performance of this dam. Generally, the dam is considered to be in fair condition. The principal areas of concern are: seepage in the stone masonry abutments under the bridge; inoperable slide gates and inaccessibility of the gate mechanisms during high flows; spalling concrete on the weir and on the gate structure; lack of adequate riprap protection on the upstream face of the dam; erosion caused by surface runoff at the downstream slope; and thick vegetation on the upstream and downstream slopes of the north abutment of the dam.

Hydraulic analyses indicate that the existing spillway can discharge a flow of 4,500 cfs at pond El 520.5, which is the low point on the bridge. The spillway may be inadequate since it can discharge only 46 percent of the test flood before the dam is overtopped. An outflow test flood of 9,850 cfs will overtop the bridge by 3.4 feet.

The limited information available indicates that in the 1955 floods water flowed at a maximum of 4.2 feet above the crest of the spillway.

b. Adequacy of Information. The lack of indepth engineering data did not allow for a definitive review. Therefore the adequacy of this dam could not be assessed from the standpoint of reviewing design and construction data, but is

based primarily on visual inspection, past peformance history and sound engineering judgment.

c. Urgency. The recommendations and remedial measures outlined below should be implemented by the Owner within one year after receipt of this Phase I Inspection Report.

d. Need for Additional Information. Additional investigations to further assess the adequacy of the dam and spillway are outlined below in Section 7.2, Recommendations.

7.2 Recommendations. In view of the concerns over the continued performance of the dam and spillway, it is recommended that the Owner employ a qualified consultant to:

a. evaluate the stability of the dam

b. conduct a more detailed hydrologic and hydraulic investigation of the site to determine the adequacy of the spillway, and

c. evaluate the seepage in the stone masonry abutments.

It should be the responsibility of the Town of Auburn to see that following completion of the sewer construction, the south abutment is backfilled according to acceptable standards.

The Owner should be aware of the possibility of future seepage through the dam along the recently installed sewer pipe. The bedding for the pipe could serve as a conduit for water to seep through the embankment, unless a complete, impervious cutoff was installed along the pipeline.

The recommendations on repairs and maintenance procedures are outlined below under Section 7.3, Remedial Measures.

7.3 Remedial Measures

a. Alternatives. An alternative to implementing the recommendations listed above and the maintenance procedures itemized below would be to drain the pond and breach or remove the dam.

b. Operating and Maintenance Procedures. The dam and spillway are not adequately maintained. It is recommended that the Owner accomplish the following:

(1) repair the gate mechanisms to make the slide gates operable and construct some form of access walk to them,

(2) repair the concrete on the weir and on the outlet structure,

(3) add riprap on the upstream face of the dam, particularly in the vicinity of the high tension tower,

(4) remove all trees and brush from the north abutment of the dam,

(5) construct a swale along the bridge to prevent erosion of the downstream face of the dam caused by uncontrolled stream runoff,

(6) institute a definite plan for surveillance and a warning system during periods of unusually heavy rains and/or runoff. The warning system should be coordinated with one at the upstream reservoirs in the watershed, because flooding or failure of the upper dams will have a severe effect on Stoneville Pond.

(7) implement a systematic program of maintenance inspections. As a minimum, the inspection program should consist of a monthly inspection of the dam and appurtenances and be supplemented by additional inspections during and after severe storms. All repairs and maintenance should be undertaken in compliance with all applicable State regulations.

(8) periodic technical inspection of this dam should be continued on an annual frequency.

APPENDIX A

PERIODIC INSPECTION CHECKLIST

PERIODIC INSPECTION

PARTY ORGANIZATION

ROJECT Stoneville Pond

DATE July 31, 1978

TIME 2:00 - 5:00 PM

WEATHER overcast, drizzle, 70°F

W.S. ELEV. 515.1 U.S. 502.8 DN.S.
Assumed benchmark Elevation 515, crest of spillway

ARTY:

1. Michael Larson
2. Richard Weber
3. Carol Sweet
4. Sue Pierce
5. Lou Taverna
6. David Cole
7. Lyle Braragan
8.
9.
10.

PROJECT FEATURE	INSPECTED BY	REMARKS
dam	Michael Larson	
spillway	Lyle Braragan	

PERIODIC INSPECTION CHECK LIST

PROJECT Stoneville DATE July 31, 1978

PROJECT FEATURE dam embankment NAME Michael Larson

DISCIPLINE geotechnical NAME Richard Weber

Note: us = upstream; ds = downstream; ws = water surface

AREA EVALUATED	CONDITIONS
AM EMBANKMENT Crest Elevation	Crest is Oxford Street, including bridge; varies from 520.5 to 522.3
Current Pool Elevation	515.1
Maximum Impoundment to Date	unknown
Surface Cracks	none visible - pavement on crest
Pavement Condition	good
Movement or Settlement of Crest	none visible
Lateral Movement	none
Vertical Alignment	slightly curved
Horizontal Alignment	slightly curved
Condition at Abutment and at Concrete Structures	abutments form wide fill areas which tie into natural ground - condition at bridge abutments generally good except at ds side of south abutment where surface runoff from road is eroding embankment
Indications of Movement of Structural Items on Slopes	no movement visible on power line pole or spillway
Trespassing on Slopes	new sewer line along south side of pond (Oxford St) minor trespassing by kids fishing
Sloughing or Erosion of Slopes or Abutments	local erosion us face - no riprap protection erosion @ ds face @ south bridge abutment due to surface runoff
Rock Slope Protection - Riprap Failures	no rip rap
Unusual Movement or Cracking at or near Toes	none visible
Unusual Embankment or Downstream Seepage	slight (northside) to moderate (south side) from ds corners of stone bridge abutment along ds channel
Piping or Boils	none visible
Foundation Drainage Features	unknown
Toe Drains	unknown
Instrumentation System	none visible

PERIODIC INSPECTION CHECK LIST

PROJECT Stoneville Pond DATE July 31, 1978

PROJECT FEATURE Outlet Works NAME R. Weber

DISCIPLINE Geotechnical NAME M. Larson

AREA EVALUATED	CONDITION
OUTLET WORKS - INTAKE CHANNEL AND INTAKE STRUCTURE	
a. Approach Channel	not visible
Slope Conditions	
Bottom Conditions	
Rock Slides or Falls	
Log Boom	
Debris	
Condition of Concrete Lining	
Drains or Weep Holes	
b. Intake Structure	not visible - submerged upstream
Condition of Concrete	poor - minor spalling, some efflorescence, cracking
Stop Logs and Slots	inoperable - 2 stanchions visible

PERIODIC INSPECTION CHECK LIST

'ROJECT Stoneville Pond DATE July 31, 1978

'ROJECT FEATURE Outlet Works NAME R. Weber

)ISCIPLINE Geotechnical NAME M. Larson

AREA EVALUATED	CONDITION
)UTLET WORKS - TRANSITION AND CONDUIT	concrete chute with 2 openings at bottom - not leaking
General Condition of Concrete	poor
Rust or Staining on Concrete	minor discoloration
Spalling	some along edges
Erosion or Cavitation	slight - small areas
Cracking	moderate
Alignment of Monoliths	good - perpendicular to spillway crest
Alignment of Joints	no joints visible
Numbering of Monoliths	1

PERIODIC INSPECTION CHECK LIST

ROJECT Stoneville DATE July 31, 1978

ROJECT FEATURE Outlet NAME R. Weber

ISCIPLINE geotechnical NAME M. Larson

AREA EVALUATED	CONDITION
UTLET WORKS - OUTLET STRUCTURE AND OUTLET CHANNEL	outlet discharge : downstream of spillway between bridge abutments
General Condition of Concrete	outlets not operable
Rust or Staining	
Spalling	
Erosion or Cavitation	
Visible Reinforcing	
Any Seepage or Efflorescence	
Condition at Joints	
Drain Holes	
Channel	
Loose Rock or Trees Overhanging Channel	
Condition of Discharge Channel	

PERIODIC INSPECTION CHECK LIST

PROJECT Stoneville Pond DATE July 31, 1978

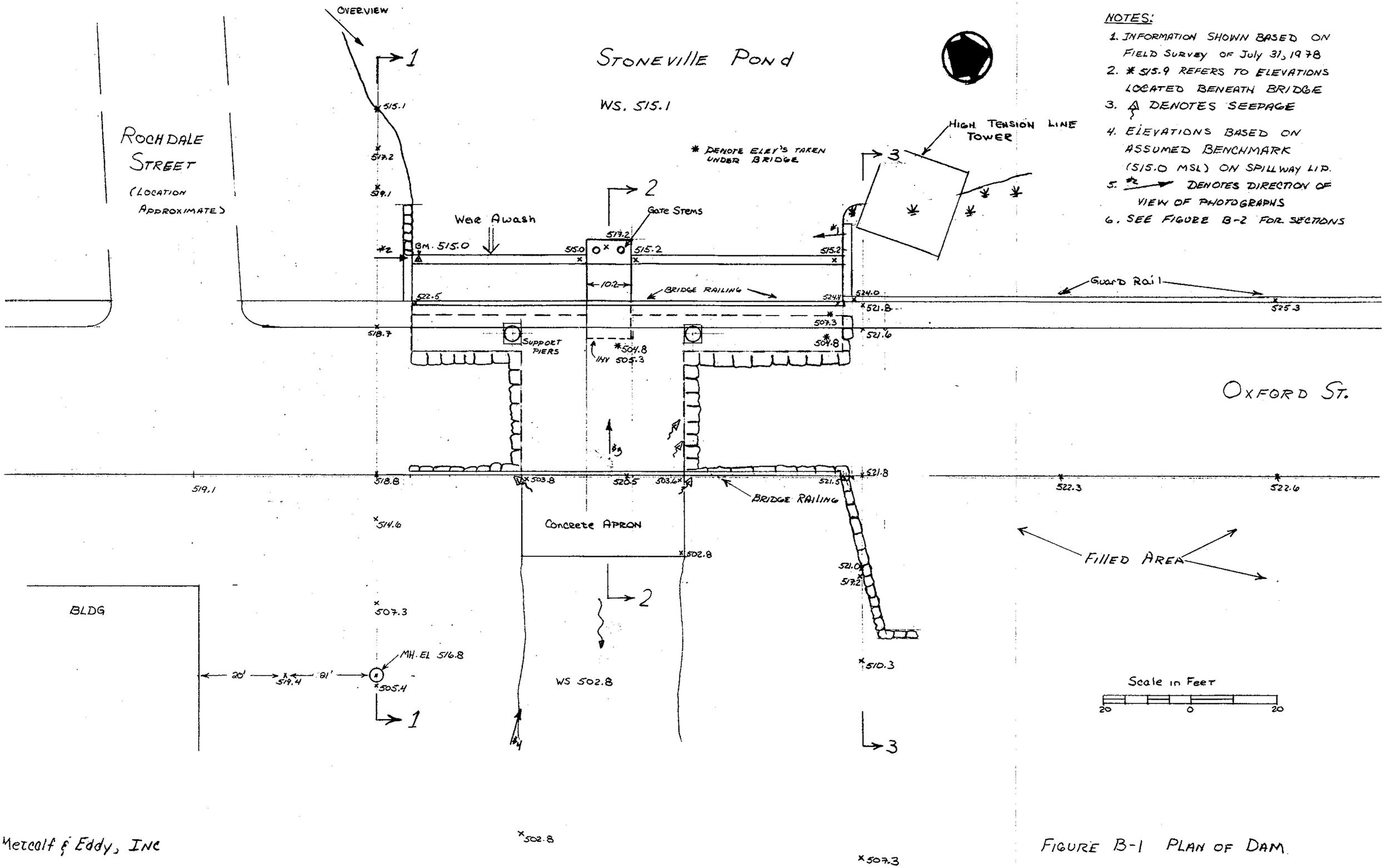
PROJECT FEATURE Spillway NAME R. Weber

DISCIPLINE Geotechnical NAME M. Larson

AREA EVALUATED	CONDITION
OUTLET WORKS - SPILLWAY WEIR, APPROACH AND DISCHARGE CHANNELS	dry stone masonry training wall at south abutment - 1.5 feet above ws
a. Approach Channel	
General Condition	poor - pieces fallen off
Loose Rock Overhanging Channel	minor - few blocks
Trees Overhanging Channel	none - power line pole at north abutment
Floor of Approach Channel	not visible
b. Weir and Training Walls	mortared masonry sidewalls concrete ogee weir - flow over south half only
General Condition of Concrete	Poor - facing eroded away - areas of moderate cavitation; sidewalls fair - some mortar missing; crack in concrete over north abut.
Rust or Staining	heavy
Spalling	none
Any Visible Reinforcing	no
Any Seepage or Efflorescence	no
Drain Holes	none visible
c. Discharge Channel	concrete surface to 20 feet ds of bridge, then stream bed lined with cobbles + boulders
General Condition	concrete - fair, irregular, eroded surface, minor cavitation
Loose Rock Overhanging Channel	none
Trees Overhanging Channel	some bushes
Floor of Channel	concrete with cobbles and boulders ds, riprap edging on channel for 60' dls of bridge
Other Obstructions	little trash and wood

APPENDIX B

PLAN OF DAM AND PREVIOUS
INSPECTION REPORTS

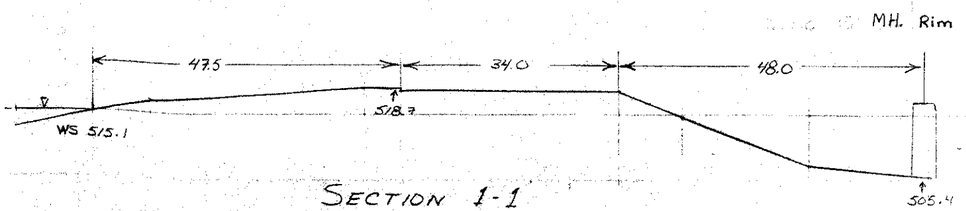


NOTES:

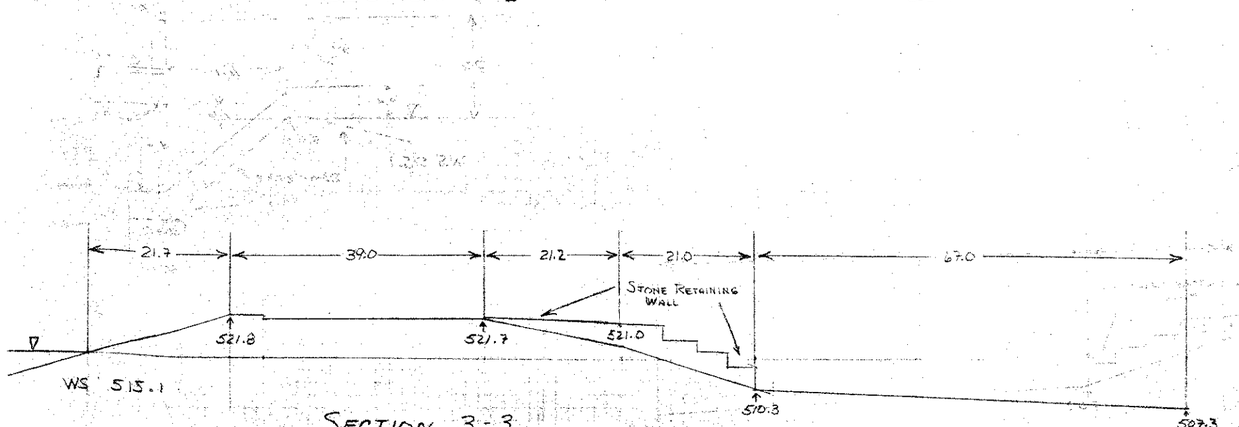
1. INFORMATION SHOWN BASED ON FIELD SURVEY OF July 31, 1978
2. * 515.9 REFERS TO ELEVATIONS LOCATED BENEATH BRIDGE
3. ⍋ DENOTES SEEPAGE
4. ELEVATIONS BASED ON ASSUMED BENCHMARK (515.0 MSL) ON SPILLWAY LIP.
5. #2 → DENOTES DIRECTION OF VIEW OF PHOTOGRAPHS
6. SEE FIGURE B-2 FOR SECTIONS

Metcalf & Eddy, INC

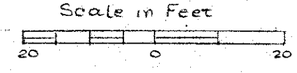
FIGURE B-1 PLAN OF DAM



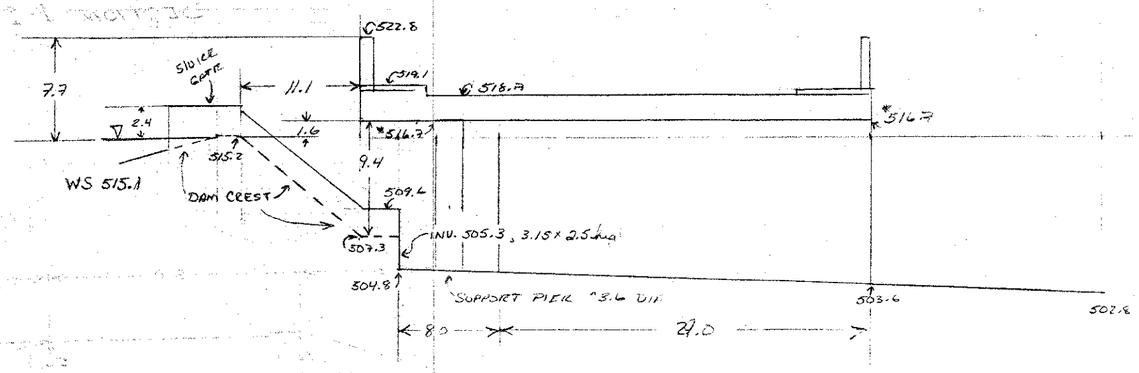
SECTION 1-1



SECTION 3-3



SECTION 2-2



* NOTE: ELEVATION 516.7 REFERS TO THE BOTTOM OF THE I-BEAMS UNDER THE BRIDGE

SCALE IN FEET

Stoneville Pond

METCALF & EDDY, INC.

FIGURE B-2 SECTIONS

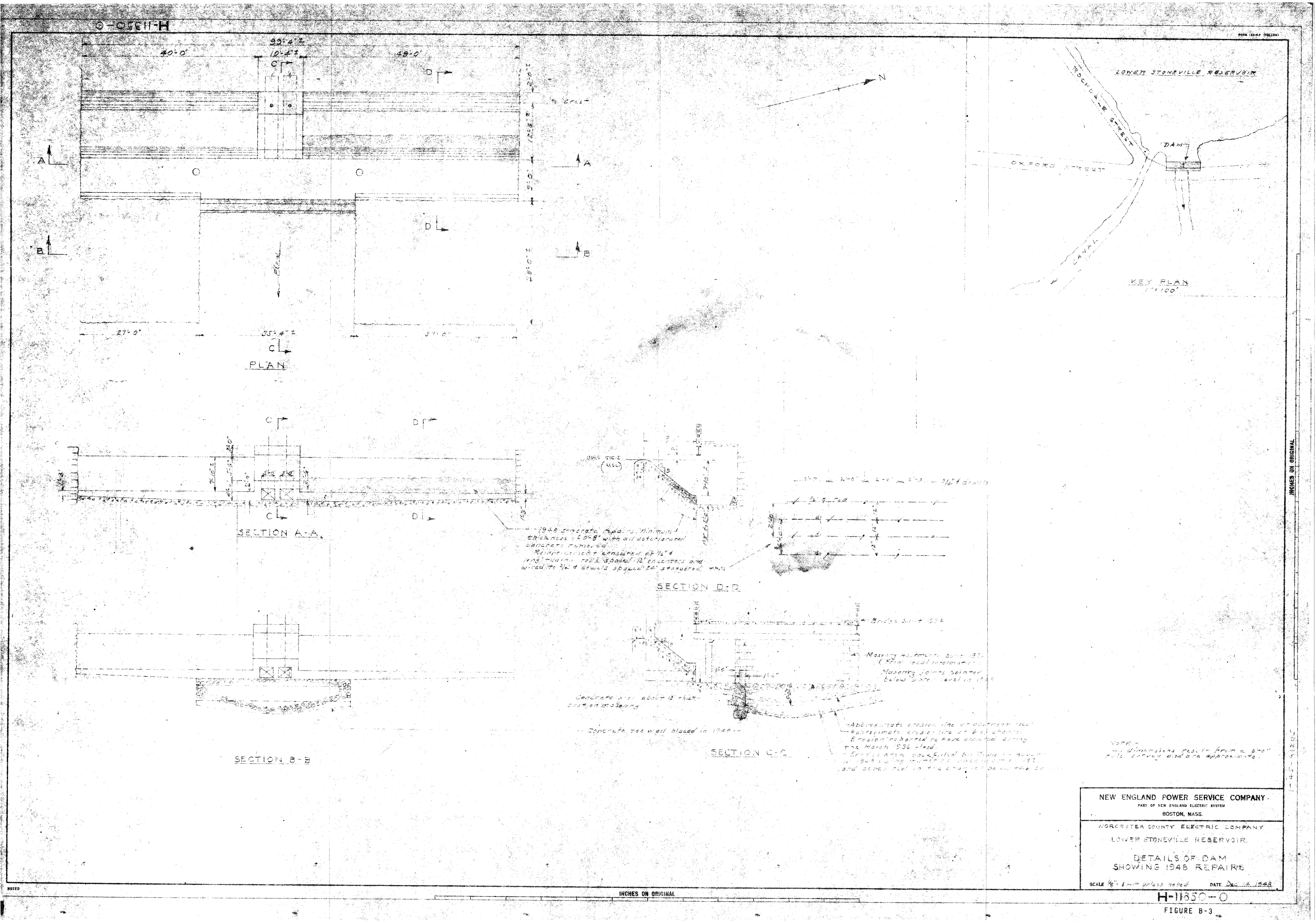

H-11350-0
PLAN
SECTION A-A
SECTION B-B
SECTION C-C
SECTION D-D
LOWER STONEVILLE RESERVOIR
KEY PLAN
DAM
CANAL
NEW ENGLAND POWER SERVICE COMPANY
PART OF NEW ENGLAND ELECTRIC SYSTEM
BOSTON, MASS.
WORCESTER COUNTY ELECTRIC COMPANY
LOWER STONEVILLE RESERVOIR
DETAILS OF DAM
SHOWING 1948 REPAIRS
H-11350-0
INCHES ON ORIGINAL

FIGURE B-3

TOWN OR CITY Auburn Topo-21B DECREE NO. (H 1 PLAN NO. 29 DAM NO. 0-3-01

LOCATION Stoneville Pond NAME OF DAM Stoneville Pond Dam C. C. DOCKET NO. 17

DESCRIPTION OF DAM El. 100'

Type	Ogee Concrete Spillway - Rough Stone Abts
Length	150'±
Height	11'±
Thickness top	Concrete 3.0 gravel 15'±
" bottom	40'±
Downstream Slope	Prob ⅓ : 1
Upstream "	(Sea Level) 2 : 1
Length of Spillway	Crest Elev. 515.1 - 98.5 89.'±
Size of Gates	2 - 2'6" x 3.0 El. 89.5
Location of Gates	4 spillway
Flashboards used	None
Width Flashboards or Gates	
Dam designed by	
" constructed by	
Year constructed	

DESCRIPTION OF RESERVOIR & WATERSHED

Name of Main Stream	Kettle Brook
" " any other Streams	
Length of Watershed	
Width " "	
Is Watershed Cultivated	
Percent In Forests	
Steepness of Slope	
Kind of Soil	Rocky
No. of Acres In Watershed	(18.25 Sq. M) 67.0
" " " " Reservoir	
Length of Reservoir	
Width " "	
Max Flow Cu. Ft. per Sec.	
Head or Flashboards-Low Water	
" " " -High "	

GENERAL REMARKS

Vol. 25 - P. 372 C.W. & J.E. Smith et al
C.A. Allen C.E. March 1876
Plan in Dam Brook.
Inspected: Aug. 13, 1925 L.O.M.
" Jan. 4, 1928 " - F.E.P.
" Dec. 17, 1931 "
" June 2, 1933 " & Mr. Taft
" Nov. 4, 1934 "
" Mar. 20 1937 - K.M. Finlayson.

GENERAL REMARKS

✓ 1971
Owned since 1945 by Worc. Co. Elec. Co.
Inspected: Mar. 20, 1937 - K.M. Finlayson
" Oct. 25, 1938 " "
Patrol Mar. 15, 1939 " "
Inspected: Dec. 11, 1940 L.H. Spofford
" " 30, 1941 - B.F. St. John
" Nov. 16, 1942 - L.O. Marden
" April 15, 1943 " "
" Jan. 17, 1945 " "

2-Library Bureau 10-92260

B-4

PREVIOUS INSPECTIONS (PARTIAL LISTING)

COPY OF INSPECTION CARD ON FILE AT THE MASSACHUSETTS DEPARTMENT OF PUBLIC WORKS, DISTRICT OFFICE, WORCESTER.

03-01

Inspected: Sept. 3, 1947 - L.O. Marden
" Nov. 8, 1948 " "
" Sept. 13, 1950 " "
" Oct. 10, 1951 "
" Sept. 15, 1954 " with Worc. County Elec. Co.
" " " " " " " (Geo. Lutke)
" June 3, 1960 " " " " " "
" March 20, " "
" April 12, 1961 " -W.O.L
Discussed with B. A. Lucander - Asst/o. Supt.

OWNED BY
MASS ELECTRIC CO, 939 SOUTHBRIDGE ST, WORC. MASS

INSPECTED - 12/14/71 - PACICELLO & NICHOLSON

B-15

INSPECTION REPORT & DATA FOR DAMS

Dam No. 17 - 01
Town: AUBURN
Stream: KETTLEBROOK
Pond: STONEVILLE POND
Date:
By:

Owner: MASS ELECTRIC CO
His Address: 939 SOUTHBRIDGE ST WORCESTER
Function of Dam: STONEVILLE POND STORAGE FOR MASS ELECTRIC
Location & Access: OXFORD ST.

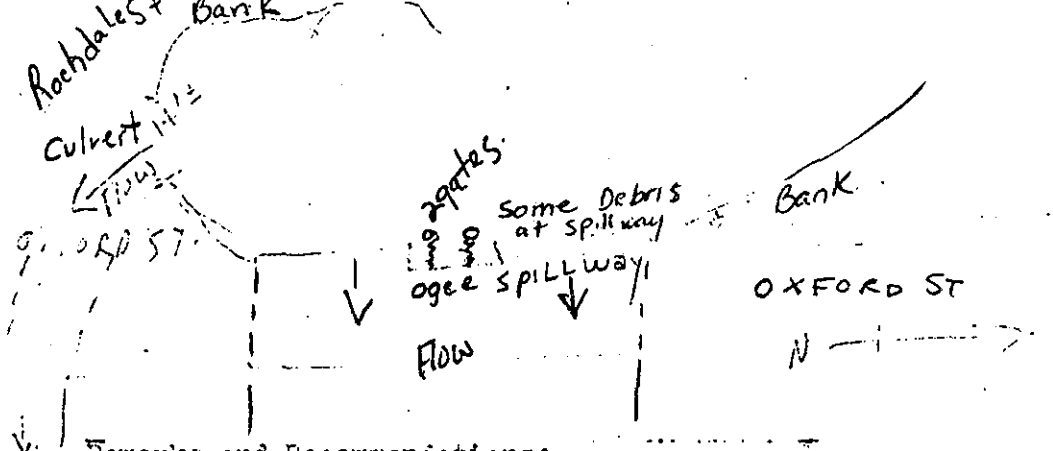
CONDITION RATING
Structural: Good
Hydraulic: GOOD
General: GOOD
PRIORITY: * HIGH

USGS Quad. WORC SOUTH Lat. 43-13-24 Long. 71-
Drain.Ar.: [illegible] Sq.Mi.; Ponds: ___ ac.; Res. Adam: ___
Character of D.A.:

Estimated
Discharge *
Capacity:

General Description of Dam and Discharge Control: OGEE CONC. SPILLWAY
" ROUGH STONE ABTS SPILLWAY 89'±
- 2 GATES - 2'-6" x 3.0' @ Center of SPILLWAY

Sketch (Not to Scale):



Remarks and Recommendations:
water flowing about 3" over ogees spillway at time of inspection Some brush growing near abutments
Concrete scaling at gates
* GATES APPEAR TO BE INOPERABLE

Date 2-14-71 By [illegible] Comment

Dam No. [illegible]

INSPECTION REPORT - DAMS AND RESERVOIRS

1. Location: City/Town AUBURN Dam No. 3-14-17-01

Name of Dam STONEVILLE POND Inspected by W. KEGAN

Date of Inspection 9/7/76

2. Owner/s: per: Assessors _____ Prev. Inspection ✓

Reg. of Deeds _____ Pers. Contact _____

1. MASS. ELECTRIC CO. 939 SOUTHBRIDGE ST. WORCESTER
Name St. & No. City/Town State Tel. No.
(Copy To Bd. of Selectmen & Con. Comm.)

2. TOWN OF AUBURN ?
Name St. & No. City/Town State Tel, No.

3. _____
Name St. & No. City/Town State Tel. No.

3. Caretaker (if any) e.g. superintendent, plant manager, appointed by absentee owner, appointed by multi owners.

Name: St. & No.:

City/Town: State: Tel.No.:

4. No. of Pictures taken _____

5. Degree of Hazard: (if dam should fail completely)*

1. Minor _____ 2. Moderate ✓ T.

3. Severe ✓ 4. Disastrous _____

* This rating may change as land use changes (future development)

6. Outlet Control: Automatic _____ Manual ✓

Operative ? yes; _____ No.

Comments: Gate operability indeterminate; furthermore now there is no Access walk To Gate block - This can be reached only at low flows by WALKING on Top of Ogive Crest.

7. Upstream Face of Dam: Condition:

1. Good _____ 2. Minor Repairs ✓

3. Major Repairs ___ 4. Urgent Repairs ___

Comments: Rebuild balanced Fieldstone wall @ S.W. extremity of Dam - U.S. Face

DNR NO. 3-14-17-01

8. Downstream Face of Dam:

Condition: 1. Good _____ 2. Minor Repairs ✓ To

3. Major Repairs ✓ 4. Urgent Repairs _____

Comments:

9. Emergency Spillway: (Stone Box Culv. @ South Abut.)

Condition: 1. Good _____ 2. Minor Repairs ✓ To

3. Major Repairs ✓ 4. Urgent Repairs _____

Comments: Conc. Header & Tailwall Badly Spalled, d.s. end obstructed with earth fill, No Control Structure (ie. gates & bulkhead or Stoplogs) Visible Conduit Stone Box Not Accessable To Inspection (would have To be dewatered for INSPECTION & REPAIR).

10. Water Level at time of inspection: _____ ft. above _____ below _____

top of dam _____ principal spillway _____

other 1" ± Above Spillway (PRINCIPAL) @ Give Crest

11. Summary of Deficiencies Noted:

Growth (Trees and Brush) on Embankment —

Animal Burrows and Washouts ✓ (C) @ S.E. Abut - D.S. Side

Damage to slopes or top of dam _____

Cracked or Damaged Masonry ✓ (E), (B) (ATTACHED Supp. Sketch)

Evidence of Seepage _____

Evidence of Piping ✓ (A) ON Attached Supp. Sketch

Erosion (C)

Leaks (A)

Trash and/or debis impeding flow (E)

Clogged or blocked spillway (E)

Other Conc. Gd. Rail & S.W. (over) Badly Spalled (Possibly Town Responsibility)

(All letters refer To Locations ON ATTACHED Supplementary Sketch)

12. Remarks & Recommendations: (Fully Explain)

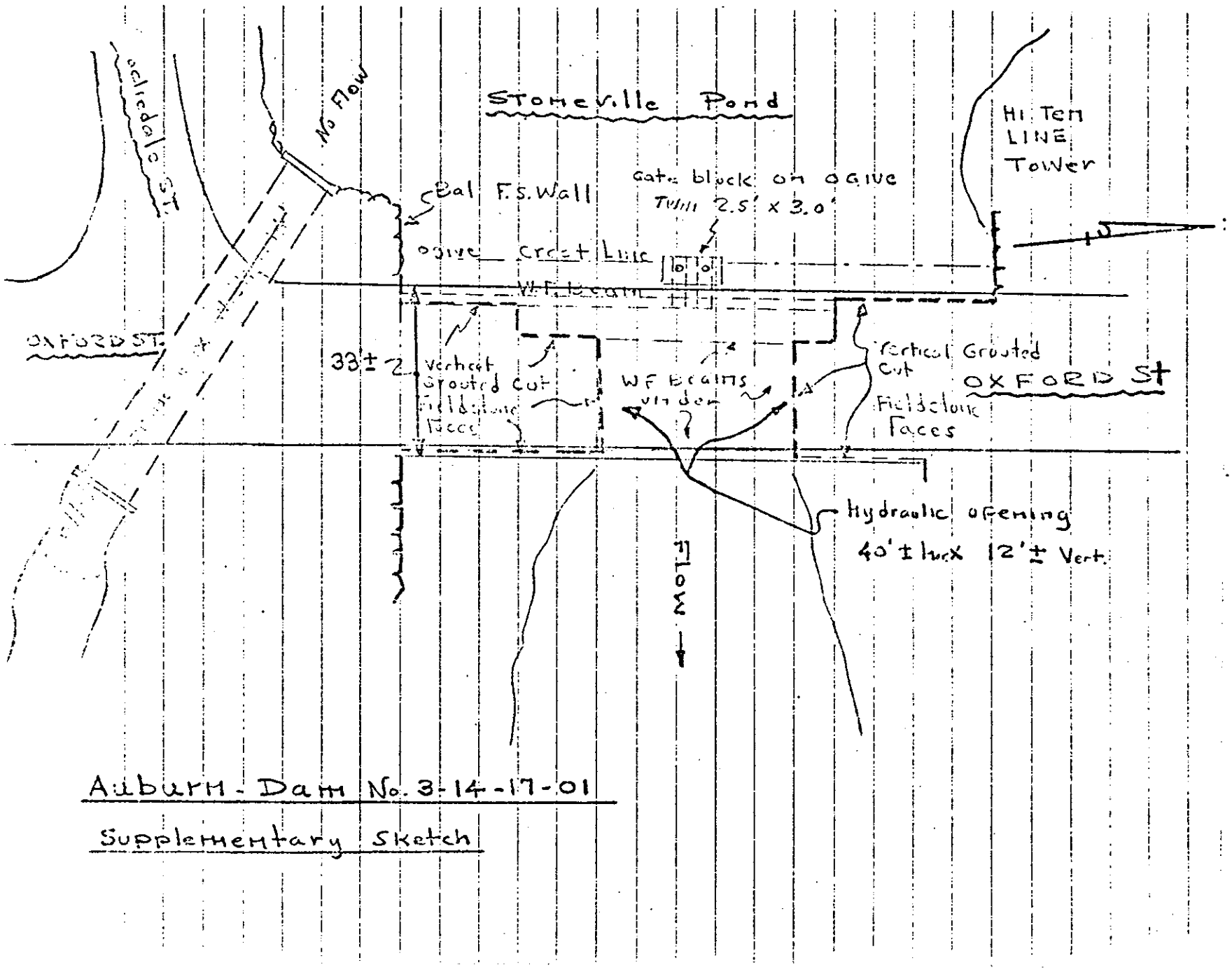
This Structure is a hybrid mixsture of an old (~~Submerged~~) & Earth fill Fieldstone dam and a newer bridge consisting of ON grouted Cut fieldstone abutments with a more recently Constructed R.C. deck on wide Flange Beams. JUst upstream of This is an ogive Spillway with Twin 2.5'x3' Gates. Under the ogive Conc. Surface is a rock filled Timber Crib Structure. Under this is The Cut off Consisting of (BRIZ)2' 30' of Clay (puddled) and Two 2½" Timber Sheet walls. This structure is not visible or Accessable To Visual INSpection, but No leakage or signifigant differential Settlement was Noted. The Surface Conc. is IN fair Condition. The Conditions Noted at "A" & "B" on The attached Sketch Could probably be easily rectified by Pointing up and grouting. The spalling of Bridge rail & S.W. Concrete is not related To dam Safety and IN any event is a Town problem. IT is very highly Probable That restoration of The Stone box Culv. at The Southerly end of The dam is necessary ~~from~~ for proper outlet Control. The Twin gates on The principal Spillway dont appear To be adequate for The Task. These gates Should be Tested for operability and restored as necessary.

13. Overall Condition:

1. Safe _____
2. Minor repairs needed ✓
3. * Conditionally safe - To major repairs needed ✓
4. Unsafe _____
5. Reservoir impoundment no longer exists (explain)

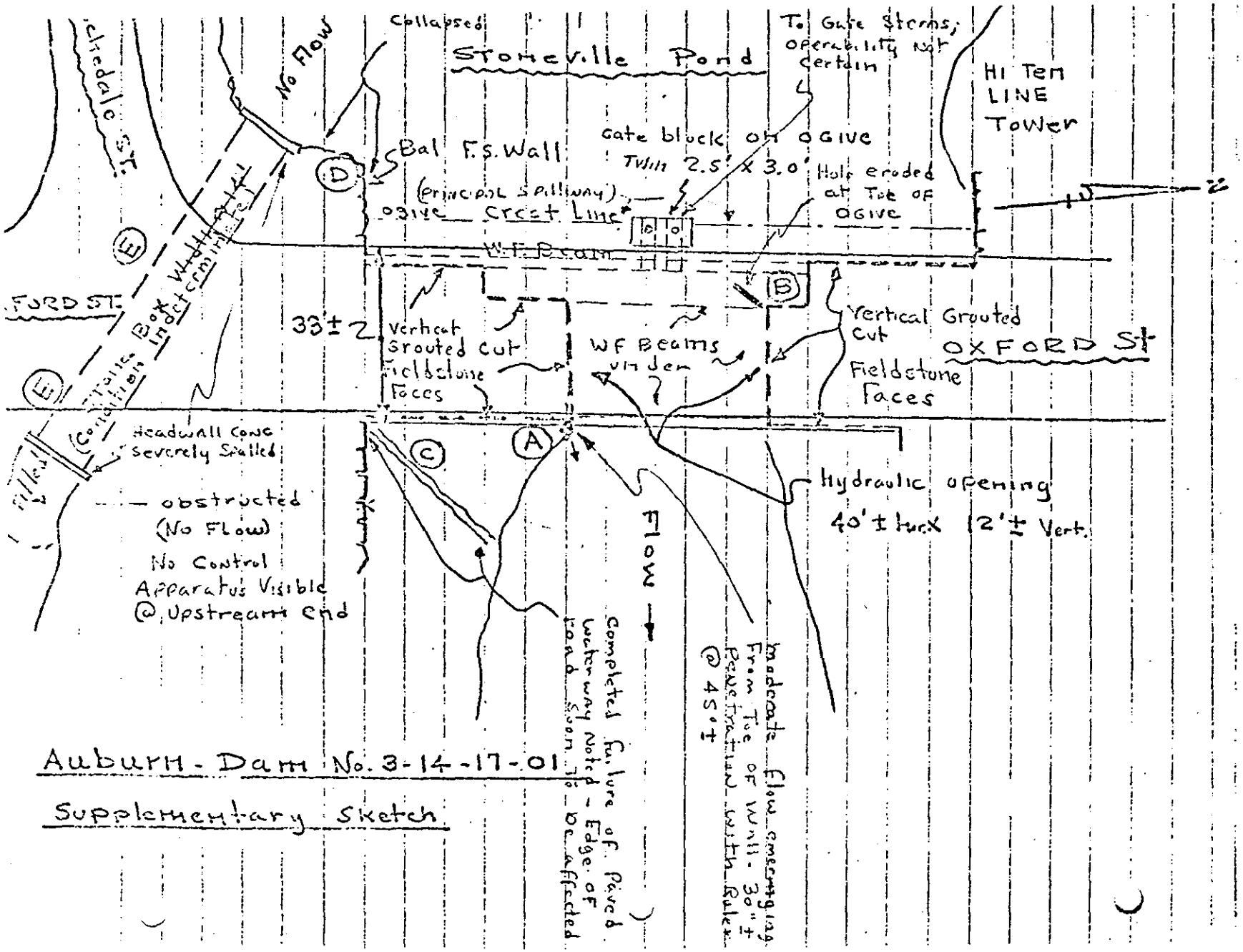
Recommend removal from inspection list _____

* When U.S End is dewatered and fill removed from D.S. end The actual Condition and required repairs on The Stone Box Culvert Can be determined. Of all The Conditions Noted above only This has The Potential (in my opinion) of Causing Major Flooding.



Auburn - Dam No. 3-14-17-01

Supplementary Sketch


Stoneville Pond
Collapsed
No Flow
To Gate Stems; operability Not Certain
Hi Ten LINE Tower
Bal F.S. Wall
(principal Spillway)
ogive Crest Line
gate block on ogive
Twin 2.5' x 3.0'
Half eroded at Toe of ogive
W.F. Beam
Chedale ST.
FORD ST.
OXFORD St
33'± 2
Vertical Grouted Cut
Fieldstone Faces
WF Beams
Vertical Grouted Cut
Fieldstone Faces
Headwall cone severely Spalled
obstructed (No Flow)
No Control Apparatus Visible @ Upstream End
Hydraulic opening 40'± Thick 12'± Vert.
Flow
Completed failure of paved waterway Noted - Edge of road Soon to be affected
Moderate flow emerging From Toe of Wall - 30"± Penetration with Rate @ 45°±
A
B
C
D
E
Auburn - Dam No. 3-14-17-01
Supplementary Sketch

The Commonwealth of Massachusetts

EXECUTIVE OFFICE OF ENVIRONMENTAL AFFAIRS
DEPARTMENT OF ENVIRONMENTAL QUALITY ENGR.
DIVISION OF WATERWAYS

100 Nashua Street, Boston 02114

May 13, 1977

Mass. Electric Company
939 Southbridge Street
Worcester, Massachusetts

Re: Insp. Dam #3-14-17-01
Lower Stoneville Pond Dam
Auburn

Dear Sir:

On 9-7-76, an Engineer from the Massachusetts Department of Public Works made a visual inspection of the above dam. Our records indicate the owner to be Mass. Electric Co. Worcester If this information is incorrect, will you please notify this office.

The inspection was made in accordance with the provisions of Chapter 253 of the Massachusetts General Laws as amended (Dams Safety Act). Chapter 706 of the Acts of 1975 transferred the jurisdiction of the so-called "Dams Safety Program" to the Commissioner of the Department of Environmental Quality Engineering.

The results of the inspection indicate that this dam is conditionally safe. The following conditions were noted that require attention:

The outlet control gate is inaccessible at high flow. Emergency spillway - conc. header and tailwall badly spalled - downstream end obstructed with earth fill - no control structure visible - area should be dewatered for inspection and repair.
Vertical field stonewalls should be grouted and pointed.

We call these conditions to your attention before they become serious and more expensive to correct. With any correspondence please include the number of the dam as indicated above.

Very truly yours,

John J. Hannon, P.E.
Chief Engineer

AH:

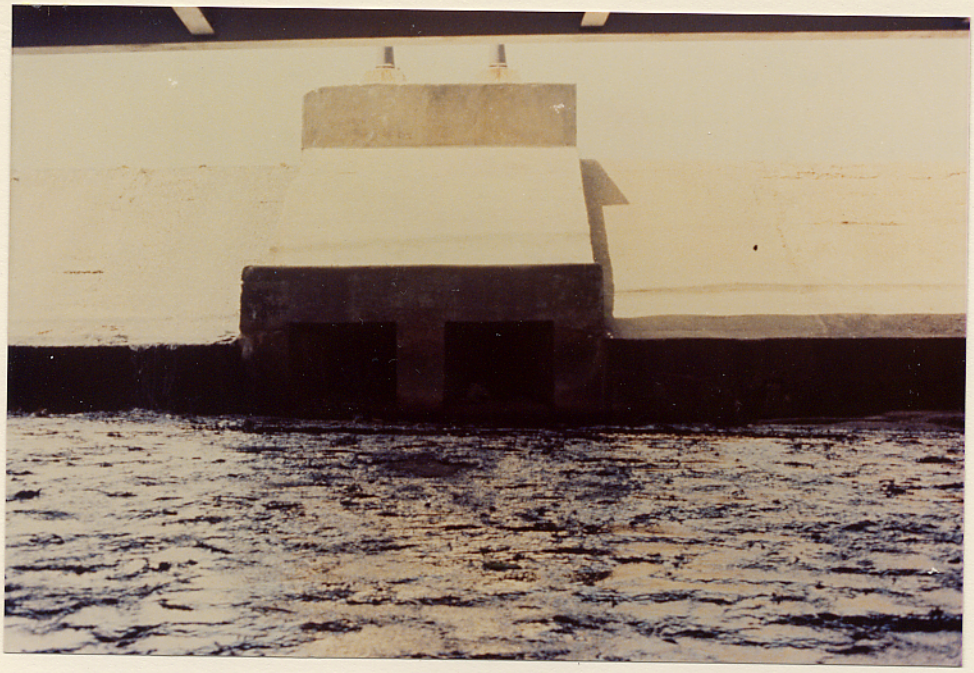
cc: J.J. Lyons DHE
W. Regan D&E Eng.
Bd. of Selectmen - Town Hall Auburn, Ma.
Cons. Comm.

APPENDIX C

PHOTOGRAPHS

NO. 1 VIEW OF SPILLWAY CREST AND
SOUTH ABUTMENT

NO. 2 VIEW OF SPILLWAY AND OXFORD
STREET BRIDGE FROM SOUTH ABUTMENT



NO. 3 VIEW OF SPILLWAY AND OUTLET

NO. 4 VIEW OF SPILLWAY AND OXFORD STREET
BRIDGE FROM DOWNSTREAM CHANNEL

APPENDIX D

HYDROLOGIC AND HYDRAULIC COMPUTATIONS

1 SHEET

LEGEND
- WATER SHED
- PRIMARY ROADS
- SECONDARY ROADS
- THICKLY SETTLED
- RAILROADS
- TOWN LINES
- (400) BODY OF WATER, DAM, ELEVATION
- (17) AREA OF WATER-SHED IN ACRES
- WATER SHEDS HAVING RUN OFF IMPONDED BY WORC. RES.

TRUE NORTH

WORCESTER · HOLDEN · PAXTON · LEICESTER · MILLBURY · SUTTON · AUBURN · OXFORD

SCALE IN MILES

POND NAME	CAPACITY OF POND IN MILLIONS OF GAL.	AREA OF POND IN ACRES	INDIVIDUAL WATERSHED IN ACRES	TOTAL WATERSHED IN ACRES	ELEV. OF TOP OF DAM SPILLWAY	ELEV. OF TOP OF FLASH BOARDS	YEAR BUILT ORIGINAL DAM	YEAR BUILT PRESENT DAM	TYPE OF DAM	HIGH WATER MARK & WATER RIGHTS	YEAR ESTABLISHED	FLOW CONTROLLED BY	MISC. INFORMATION
01-02 CENTRAL WORKS *	5.3	5.3			443.40		1814	1899	EARTH MASONARY TIMBER CORE. PLAN B 177 1899 REPAIRS 1936 PLAN 12718	ELEV 443.47 COPPER BOLT TOP OF STONE BOUND 11.5 SOUTH OF AND 153' W FROM S.E. COR OF MILL FROM PLAN 1046 - BOUND IS SHOWN AS 60' UP STREAM FROM SPILL - WAY PROP. PLAN - 8038	1873 BY SUPERIOR COURT DEGREE VOL. 22 CROMPTON CARPET CO. DEFENDANT	AMERICAN STEEL & WIRE CO	
01-06 COES RESERVOIR *		119		4229								NO AGREEMENT - COES CO	
01-05 CURTIS POND *	160	62	883	16663						ELEV. 473.51, TWO FEET BELOW BOLT IN EAST CONCRETE WALL OF SPILLWAY. WORCESTER ELECTRIC LIGHT PLAN # 1336	JAN 30, 1914 BY H.A. PRATT PRIV. ENG.	NEW ENG. POWER ASSOCIATES AM. S & W. CO. CAN OBTAIN WATER IN EMERG.	OLDEST WATER PRIVILAGE IN SYSTEM, WORC. COUNTY ELEC. LIGHT CO USES 2 MIL. GAL. 24 HRS. (1921) FOR CONDENSING, POND KEPT FULL
03-03 HILTON POND	40	26.4	1347	6732	96.56	96.38		1939	GATE IS SCREW STEM 24" PIPE EARTH WITH CONCRETE CORE WALL PLAN FOR CORE WALL 5642 - CONCRETE SPILLWAY PLAN 13530 - 31 10591 REPAIRS	WATER RIGHTS PURCHASED 1917 FROM HILTON HEIRS BK 2123 PAGE 293 PROPERTY PLAN 8034 HIGH WATER MARK		AMERICAN STEEL & WIRE CO	
01-15 LEESVILL POND	125		1522	15780									
03-05 MOSS RESERVOIR	256	158	699	699	110.79	112.17	CONCRETE	EARTH ADDED 1928	CONCRETE GRAVITY SECTION, COVERED WITH EARTH	ELEV. 112.05 BRASS PLUG IN LEDGE, EAST SIDE OF POND, 208' SOUTH OF SPILLWAY CREST PLANS 14628 - SEE PLAN 8044 A FOR PARCELS PURCHASE - ALSO 8771 - 8777	OCT. 21, 1924 BY COUNTY COMM.	CONSOLIDATED RENDERING CO.	NECESSARY TO KEEP POND FULL FOR SUCTION OF THEIR PUMPS
03-04 PONDVILLE POND	125	45	2639	4746			1921		GATE SCREW STEM, 30" x 30" BOX OUTLET STONE MASONARY			AMERICAN STEEL & WIRE CO.	DURING SUMMER MONTHS RESERVOIR LOSES 2" OF WATER WITHOUT DRAW DOWN
30-21 RAMSHORN POND	720	145	1527	1527	22.0	24.0	PREVIOUS TO 1831	10 ADDED 1872-3	GATE SCREW STEM, 24" ϕ OUTLET PIPE (POSSIBLY) 30" EARTH PUDDLED 10' EITHER SIDE CHESTNUT CUTOFF WALL ALONG DAM & (1873) PLAN 13515 A & B			LAREE FABRICS MILLS INC WE HAVE NO AGREEMENT	USED FOR CLEANING & CONDENSING PURPOSES NO POWER USE
30-20 RAMSHORN MEADOW POND	22	38	580	2107				1916	GATE 36" ϕ OUTLET EARTH WITH CONCRETE COREWALL, CONCRETE SPILLWAY PLAN 7171	ELEV. 24.29' IRON PIN IN LEDGE ON WESTERLY SHORE. ELEV. OF N.W. COR. OF N.W. BRIDGE WING WALL - 30.00 PROPERTY MAP 8033	1872 REG. OF DEEDS, BK. 875, P132-149 PURCHASED BY A. CURTIS AS TRUSTEE FOR RAMSHORN POND CO. PREVIOUS TO RAISING DAM	RAMSHORN POND ASS. - A.S & W. CO WORC. COUNTY ELEC. HOPEVILL MFG CO. CONSOL. RENDERING WHITTALL EL. ON BLACKSTONE RIVER AM. S & W. CO. DAY CLOVER, W. WINDLE	MIN. FLOW REQ BY SMALL MILLS WHEN IN OPERATION IS 6" THRU 36" WIDE W.G.R. = 2,500,000 GAL. DAY FROM A.W. CLOVER FLOW FROM 1904 TO 1939 NEVER HAS EXCEEDED 10" OVER SPILLWAY
61-03 STILL WATER POND *	35	30	605	24319								WHITTALL ASSOCIATES CALL ENG. RM FOR FLASH BD CHANGE	USED FOR IMPONDING DURING RAINS & IN WINTER TO ENABLE CLOSING OF RAMS HORN POND GATE USED FOR POWER WHEN PLENTY OF WATER OTHER USE IS FOR CLEANING
03-01 STONEVILLE POND		45	4870	7466					RACK, PINON & CONCRETE ϕ	PROPERTY MAP 8769 (1904)		QUEENSBURY COMBING CO NEW ENGLAND POWER ASSOCIATES PURCHASED IN 1945	THE AGREEMENT IS THAT QUEENSBURY COMBING CO. CAN DRAW SUFFICIENT WATER TO RUN PLANT. WE CAN OBTAIN WATER BY CONSULTING N.E. POWER CO.
03-02 STONEVILLE RESERVOIR	185	68	1772	1772						PROPERTY MAP 8769 (1904)			
03-07 SOUTHGATE POND	1.5	1.5	83	782					GATE 30" ϕ OUTLET EARTH & STONE WALL	FROM M. BONZEY 1917 BK. 2123, P. 290		AMERICAN STEEL & WIRE CO.	DAM WASHED OUT
61-01 SOUTH WORKS POND *	20.0	130	381	24700	438.04	440.04		1891	FLOOD GATE - RACK & PINION, INTAKE GATE - SCREW STEM INSTALLED IN 1943 - MASONARY, PLAN 3955 INTAKE 14454 A-H SECTIONS THU POND 3265 (1906) 12792 (1936)	ELEV. 443.47 SAME AS (CENTRAL WORKS) ESTABLISHED IN EXCHANGE OF TITLES BETWEEN HOLY CROSS, AM. S. & W. CO. CITY OF WORCESTER AND P.F. & F.W. TAYLOR PROP. PLAN 8041.	AP. 29, 1909 BK. 1904, P. 68 THIS IS (TAYLOR DEED)	AMERICAN STEEL & WIRE CO.	18,700,000 GAL. PER DAY REQ. FOR SOUTH WORKS & WIRE MILL AS MEASURED IN 1942 PREPARITORY TO INTAKE CHANGES

* RUN OFF FROM WATERSHED EFFECTED BY CITY STREETS AND STORM SEWERS (PLANS FOR MOSS RES. DAM: CONCRETE, ORIGINAL DAM 8510 TO 12, PRES CONST. 10584, 10582-3, 10507 & S10400, S14628) PROPERTY, 1877, 8044 A & LOTS PURCHASED IN CEDAR SWAMP 8771

NOTE: THE INFORMATION SHOWN ON THIS PLAN WAS DRAWN EXISTING PLANS, & FROM FILES OF SUPT. OF ENG. & MAINT. PARTICUARLY THE G.E. GOODRICH REPORT NOV. 14, 1921 AND "MOSS RESERVOIR", DATA CONCERNING ORIGINAL OWNERS OF CEDAR SWAMP

WORCESTER COUNTY COMMISSIONERS
WORCESTER COUNTY ENGINEERING DEPARTMENT
PLAN OF
DAMS
FOR
AMERICAN STEEL & WIRE CO.

COUNTY COMMISSIONERS
JAN. 1, 1947
MEETING DOCKET
SCALES AS NOTED

TRACED BY: BPP
TRACING CHECKED BY: W.O.L. DAM NO.

COUNTY ENGINEER

AMERICAN STEEL & WIRE CO
SUBSIDIARY OF
UNITED STATES STEEL CORPORATION

ENGINEERING DEPARTMENT USS WORCESTER MASS

DRAWN BY JAN. 1, 1947 BROUGH
SCALE 1" = ½ MILE

17720

WATER SHED OF SOUTHWORKS POND

DAM NOS. AS NOTED IN PLAN

WATERSHED PLAN FIGURE D-1

Project Nat. Review of Non Fed. Dams Acct. No. 5864 Page 1 of 6
Subject Worcester Mass. Area Comptd. By LEB Date 7/25/78
Detail STONEVILLE POND DAM Ck'd. By [illegible] Date 8/2/78

(I) Test Flood & 100 Year Storm Inflow, Storage Function

A - Test Flood

Stoneville Pond has a tributary area of 18.7 mi² & regulates a major portion of the flow to Leesville Pond. Comparison of the total Leesville D.A. w/ the section regulated by Stoneville, on a U.S.G.S. map, suggests that Stoneville may have a lower peak runoff rate than Leesville. However, use the "Leesville Curve" to obtain, for 18.7 mi², a PFR = 1100 cfs/mi²
Use 50% of this value for Test Flood due to low dam hf.

$\therefore$ Inflow Test Flood $= \frac{1}{2}(1100)18.7 = 10285$ cfs

B - 100 Year Flood

Allow 0.18 in/hr. infiltration using a 6 hour rainfall of 4.7"

$$\text{100 Yr. Flood Inflow} = \left(\frac{4.7-1.1}{19-1.1}\right)20570 = 4137 \text{ cfs.}$$

C - Storage Functions

1 - Inflow Test Flood:

$$Q_{out_{TF}} = 10285\left(1 - \frac{S}{9.5}\right) = 10285 - 1082.6\,S = F_{TF}$$

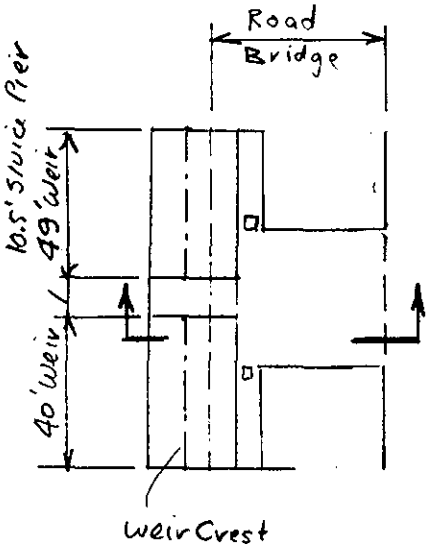
2 - 100 yr Flood

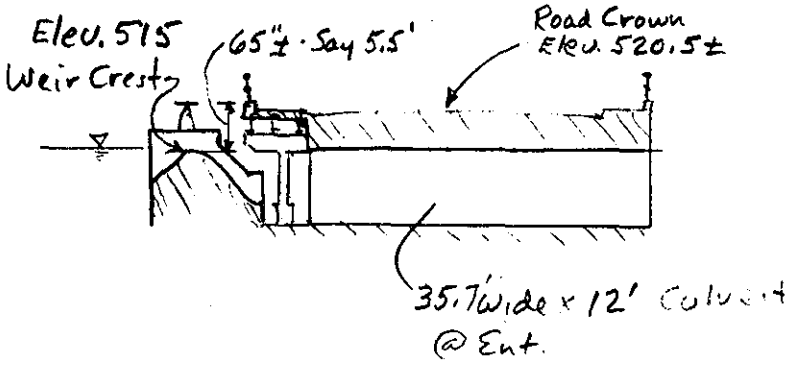
$$Q_{out_{100}} = 4137 - 880.2\,S = F_{100}$$

Note: S = Storage in Pond in terms of inches of rain on the drainage area.
D = Depth of Storage in Feet on Pond - relates to head
Area of Pond = 0.067 mi²
Area of D.A. = 18.7 mi²

$\therefore$ $S = 12D\left(\frac{0.067}{18.7}\right) = 0.043\,D$

(II) Discharge & Storage Function vs Pond Elev.





A - Weir Discharge

$$Q_w = C L H_w^{1.5}$$

Weir is Generally O-Gee Shape, w/ $C \simeq 4$

Use $C = 3.9$ w/out side contraction reduction; $L = 89'$

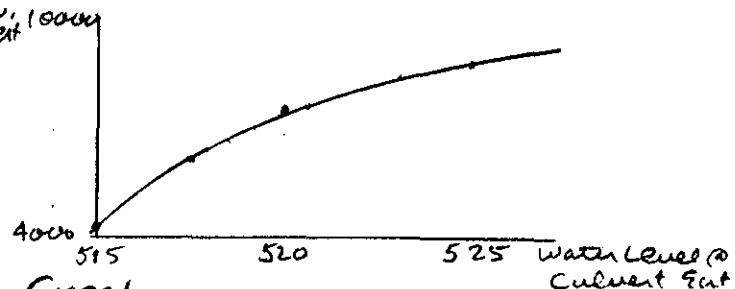
$\therefore Q_w = 347.1 H_w^{1.5}$ with $H_w = 0$ @ Pond El. 515.

B - Culvert Discharge (Ref V.T Chow - "Open Chan. Hydr." - pg 479)

Culvert 12' high by 35.7' wide. Top of culvert @ El. 515 ±

(q taken from Fig 17-29)

H/d	q	Q_p	Water Elev. above Culvert
1.0	120	4280	515
1.25	170	6070	517.5
1.5	210	7500	520.0
2	250	8920	525.0
3	310	11070	535.0



C - Flow Over Dam Crest.

Length of Crest = 300' ± (incl. road bridge) - Use 190' - omit bridge

Elev. 522 ± - generally flat.

$Q_c = 190 (2.55) (H_c)^{1.5}$; with $H_c = H_w - 7.0$

(II) (Cont.)

Pond Elev.	Q_W *	Q_P *	Q_C	Q_{Tot}	S	F_{TF}	F_{100}
516	347	N.A.	—	300	.043		
517	982	N.A.	—	1000	.086		
518	1804	N.A.	—	1800	.129		
519	2777	N.A.	—	2800	.172		
520	3881	N.A.	—	3900	.215		3948
520.5	4477	N.A.	—	4500	.236		3924
521	5101	N.A.	—	5100	.258		3910
522	6428	N.A.	—	6400	.301		
523	7854	(7854)	485	8300	.344	9913	
524	(9372)	8600	1370	9970	.387	9866	
525	(10977)	8900	2500	11400			

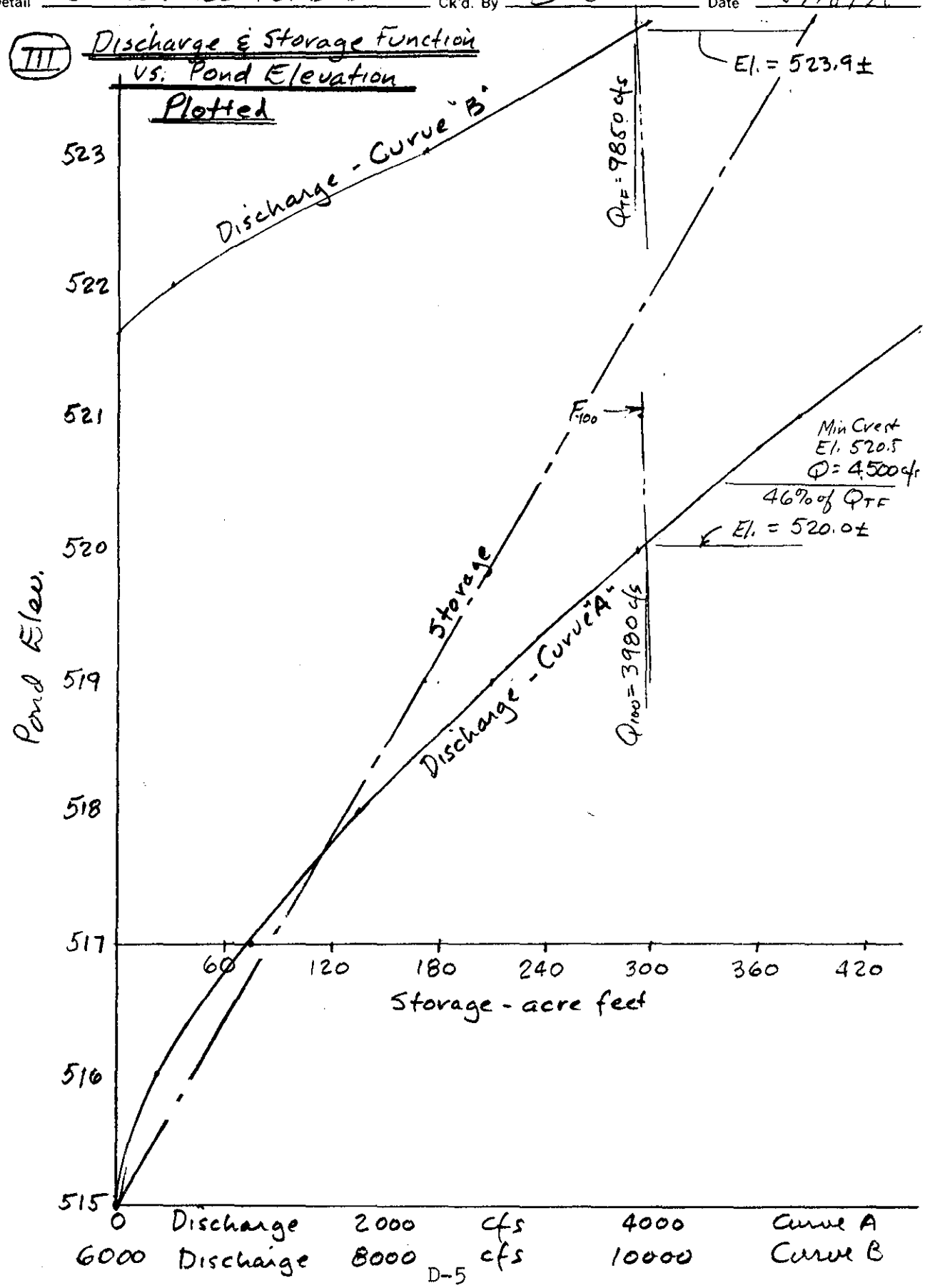
* Q_P is culvert flow with water elev. @ culvert calc. not to exceed 70% submergence of weir flow
N.A. & Values in brackets are omitted from Q_{Tot}
Above Pond El. 523 ±, Culvert "controls" & Q_P is taken from direct pond elevation.

D-Low Level Outlets [Ref.: Chow - "Open Chan. Hyd." pg 498, Fig 17-29]

Outlets consist of 2 - 2.5'x 3' wide sluice ways, invert elev. 505.5
W.S. @ Spillcrest = Elev. 515; H = 9.7', H/d = 3.9, q = 25 cfs/ft
Total Disch. = (3'+3')25 = 150 cfs or 8.02 c.s.m.
Note: These outlets are presently inoperative.

Project Nat. Review of Non Fed Dams Acct. No. 5804 Page 4 of 6
Subject Worcester Mass. Area Comptd. By LEB Date 7/26/78
Detail STONEVILLE POND DAM Ck'd. By [illegible] Date 8/18/78

(III) Discharge & Storage Function vs. Pond Elevation Plotted



(IV) Summary of Results (use Item III)

A- Test Flood

Peak Outflow for Q_{TF} = 9850 c.f.s w/ Pond El. 523.9 ± (527 c.s.m.)

Flow Over Dam Crest = 9850 - 8500 = 1350 cfs.

Flow/ft = $\frac{1350}{190}$ = 7.10 cfs/ft

Critical Depth = 1.16 ft; Critical Vel. = 6.1 fps.

B- 100 Year Flood

Peak Outflow for Q_{100} = 3980 cfs. w/ Pond El. 520.0 ± (213 c.s.m.)

No Crest Flow

C - Max. Spillway Capacity (no crest flow)

4500 c.f.s. w/ Pond El. 520.5

This is 46% of Test Flood Outflow

(V) Storage

Assume pond area const. @ .067 mi² over range of flood storage.

∴ One foot rise in storage = 43.1 acre feet

9 foot rise above spillway crest = 388 acre feet

(VI) Failure of Dam

Peak Failure Flow:

Pond Elevation - 520.5
Toe Elevation — 505.0
Y_o = 15.5

Dam Length Subject to Breaching = 160' (Omit Bridge)

$W_o = 40\%(160) = 64$

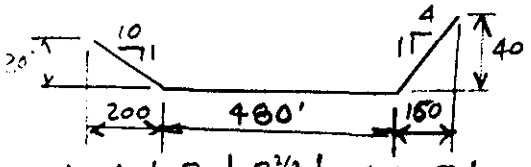
$Q_{P_1} = 1.68\, W_o (Y_o)^{1.5} = 1.68(64)(15.5)^{1.5} = 6600$

Spillway Flow = 4500 c.f.s. ; T.W. Depth = 2.3' ; Q_1 = 11,100 cfs.

Storage Volume Released:

Storage Above Spillway [From Graph]	257
Storage Below Spillway = $\frac{1}{3}(10)(.067)640$ =	143
S = Total Storage =	400 ac. feet

Channel Hydraulics:

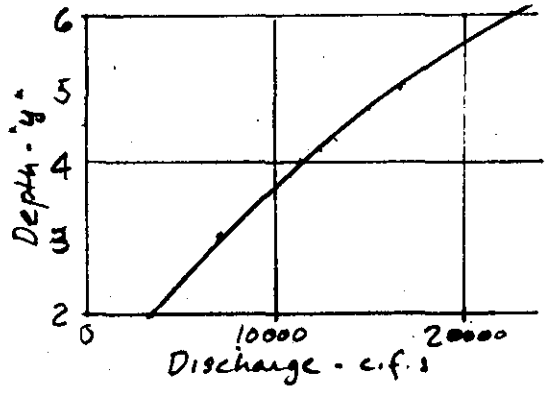


$S = \frac{10}{1700} = .0059$; $n = .05$

$V = 2.28\, R^{2/3}$

$A = y(480 + 7y)$; $P \simeq B = 480 + 14y$

y	A	P	$R^{2/3}$	V	Q
6	3132	564	3.136	7.15	22390
4	2032	536	2.431	5.54	11264
5	2575	550	2.800	6.38	16430
3	1503	522	2.024	4.61	6936
2	988	508	1.558	3.55	3510



L = 600' - To 1st Trans Tower

$Q_1 = 11{,}100$; $y_1 = 4.0'$; $A_1 = 2032\,ft^2$; $\Delta Vol_1 = 12.2$ ac. ft. (T.W. Incr.)

Trial $Q_2 = 11{,}100\left(1 - \frac{12.2}{400}\right) = 10800$ cfs. ; Wave Ht $\simeq 3.8 = y_2$

Final Wave Ht. = 3.9', $Q_{Fin.} = 11{,}000$ cfs ; $\Delta T.W. = 3.9 - 2.3 = 1.6'$

Time to Drain:

$$\frac{43560\,(400)}{3600\,(\tfrac{1}{2})(6600)} = 1.5 \text{ Hours. or } 88 \text{ min.}$$

APPENDIX E

INVENTORY FORMS